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TYPHOID PERFORATION*

A STUDY OF 139 CASES AND 16 SUPPOSED CASES OCCURRING IN THE PENNSYLVANIA HOSPITAL

BY JOHN H. GIBBON, M.D.

OF PHILADELPHIA

PROFESSOR OF SURGERY, JEFFERSON MEDICAL COLLEGE; SURGEON TO THE PENNSYLVANIA HOSPITAL

ONE who writes, and certainly one who reads, a statistical paper must expect to be asked his reasons for doing so. My first excuse is that the subject of "Acute Surgical Complications of Typhoid Fever" is before the American Surgical Association for discussion, and my second that it might prove of interest to study a large series of cases from one institution. Certainly such a series ought to prove more instructive than a collection of reported cases, because in this series are included all the cases operated upon regardless of the issue, all the cases where the diagnosis was made at autopsy, no operation having been done, and all the cases operated upon for perforation and yet in which no perforation was found; a value which unfortunately does not pertain to a collection of cases from the literature.

I should like to say that the 128 cases subjected to operation during the period covered by this study, 1901 to 1915, were operated upon by the following members of the surgical staff of the hospital: Doctors Richard H. Harte, James P. Hutchinson, Robert G. Le Conte, John H. Gibbon, Francis T. Stewart, Charles F. Mitchell, Francis O. Allen, and Arthur E. Billings. I should also like to acknowledge my obligation to Doctor Billings, who made the synopsis of the case histories, which form the basis of this paper.

The history of the surgical treatment of typhoid perforation has been well written by the fellows of the Association, and their contributions on the subject are too numerous to mention individually, and besides, it is not our object to present a bibliography of typhoid

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perforation, but simply to study all the cases of one institution and give our conclusions from this study. The late J. Alison Scott, one of the attending physicians of the Pennsylvania Hospital (*University of Pennsylvania Medical Bulletin,* May and June, 1905), presented an analysis of 50 cases of typhoid perforation, which had occurred in the hospital from 1901 to 1904, inclusive.

Prior to the period included in Scott's paper, beginning with 1901, there were three cases which should be mentioned. In 1896, Doctor Le Conte operated upon a case of typhoid peritonitis, under the impression that it was an acute appendicitis, and found no definite perforation, but numerous ulcers threatening perforation and a purulent exudate. The patient subsequently developed a fecal fistula, but recovered. In 1898, Doctor Harte operated upon the first two cases of perforation, the diagnosis having been made before operation; both died. Doctor Harte also performed the first successful operation for typhoid perforation in the Pennsylvania Hospital in 1902.

In the beginning of our work of collecting the histories of the cases, it appeared that the total would far exceed the number used as a basis for this paper, but many were eliminated because perforation was not absolutely proven by operation or autopsy, which has been our guide in order to eliminate doubtful cases. We have, however, collected and will refer later to the cases diagnosed as perforation, subjected to operation, and yet no perforation found.

The following table shows the number of cases of typhoid fever treated, with the number of perforations, the general mortality, etc., in the whole period of fourteen years:

Year	Total number of typhoid cases	Total number of deaths	Perforations	Operations	No operation	Recovery in operation cases
May 1901–1902 ...	509	35	8	7	1	2 or 28.5
May 1902–1903 ...	749	55	15	11	4	4 or 36.3
May 1903–1904 ...	690	63	24	19	5	6 or 31.5
May 1904–1905 ...	462	34	9	8	1	0
May 1905–1906 ...	596	56	15	8	7	0
May 1906–1907 ...	700	64	18	17	1	4 or 23.5
May 1907–1908 ...	524	43	14	10	4	4 or 40
May 1908–1909 ...	324	25	8	7	1	2 or 28.5
May 1909–1910 ...	234	19	4	3	1	0
May 1910–1911 ...	227	21	6	5	1	0
May 1911–1912 ...	156	13	2	2	0	0
May 1912–1913 ...	202	14	2	2	0	0
May 1913–1914 ...	304	21	4	3	1	0
May 1914–1915 ...	214	18	10	10	0	5 or 50
	5891	481	139	112	27	27 or 24.1

In this series 112 patients were operated upon with 27 recoveries, or 24.1 per cent., in 27 cases no operation was done and all died. A glance at the table shows that between 1909 and 1914 there were 15 operations and no recoveries, but in the past year there were 10 operations and 5 recoveries. These figures, I take it, go to show how valueless is a small collection of cases when one wants to get an idea of the mortality of an operation. Here we have in the same hospital, at the hands of the same group of surgeons, 15 consecutive operations with the mortality 100 per cent. and then 10 operations with a mortality of but 50 per cent. Can there be any explanation of this great difference, either in the condition of the patients at the time of operation or in the technic employed? In the 5 years when no recoveries followed operation in 15 cases, there were treated 1123 cases of typhoid fever with a general mortality of 7.8 per cent., while in the past year, when one-half of the operations were followed by recovery, there were treated 214 cases of typhoid with a general mortality of 8.8 per cent.

A careful review of the case histories in these two groups does not show that in the first group the type of disease was any more severe than in the second, nor is there anything else discernible in the patients' conditions which would account for the great difference in the mortality rate. One fact, however, which stands out prominently is that in the first group the average time elapsing between the first symptoms of perforation and operation was 20 hours, while in the second group the average time was 10 hours. Of course it is difficult to estimate in many of the cases the time between perforation and operation, but in making our estimate in the two groups, we have deliberately tried to favor the first. With these facts before us, no one can doubt that the difference between a mortality of 100 per cent. and one of 50 per cent. is at once explained. Delay after symptoms of perforation develop is fatal, every hour is valuable and one must not wait until he is sure that a perforation has occurred before operating. What we must determine is whether the symptoms are suggestive enough to warrant exploration. It is far better to make the mistake in a few cases of operating when no perforation is present than to delay operation until the diagnosis is certain.

Where there is delay it is due either to the physician, the surgeon, or the patient. One of our late physicians was extremely conservative in these cases and would never allow a surgeon to operate early. All of his cases are included in our series. Occasionally the surgeon himself delays operation and usually because he thinks the abdominal symptoms

are due to a thoracic lesion. In order to avoid delay the most intimate co-operation must exist between medical and surgical staffs. For years it has been a rule at the Pennsylvania Hospital, with the one exception already noted, that when a patient suffering from typhoid fever developed abdominal pain, the surgeon as well as the physician was at once notified. This prompt action has resulted in the saving of many lives. The most common cause of delay is in obtaining the permission for operation from the patient or his relatives. In order to prevent this, it is wise to obtain a conditional consent in every case of typhoid fever.

Rather than offer an analysis of the symptoms, pathology, etc., presented in this series of cases, it has seemed wiser to deal with them generally, and see if any new information can be extracted which will aid us in making an earlier diagnosis or improving our operative results. Before going into the important questions of diagnosis and treatment, it would be well to study the errors in diagnosis. First let us take the cases in which operation was done for a supposed perforation, which was not present. There have been 16 of these cases, Scott reporting 7, and we now present an outline of 9 cases, occurring since 1904. Scott's 7 cases may be summarized as follows:

CASE I.—*Typhoid, two relapses; suppurative arthritis of knee-joint; supposed perforation. Operation; no perforation found. Death 6 hours later.* No autopsy and no cause for symptoms found.

CASE II.—*Typhoid, diagnosis perforative peritonitis. Operation; acute appendicitis (not due to ulceration) found. Death from pneumonia 13 days later.*

CASE III.—*Typhoid, diagnosis perforation. Operation; no perforation or other lesion found. Pneumonia and recovery.*

CASE IV.—*Typhoid, diagnosis perforation. Operation; no perforation or other lesion found. Recovery.* Hemorrhage probable cause of symptoms.

CASE V.—*Typhoid, diagnosis perforation. Operation, no perforation or other lesion found. Recovery.* Complicated by consolidation of left base.

CASE VI.—*Typhoid, diagnosis perforation. Operation, no perforation or other lesion found. Death 6 days later.* Autopsy showed "active Zener's degeneration of the abdominal muscle" where a hypodermoclysis had been given 9 hours before operation. Operator was not informed of the site of hypodermoclysis, and yet this probably caused symptoms suggesting perforation.

CASE VII.—*Typhoid, diagnosis perforation. Operation revealed perforated appendix, not due to ulcer. Recovery.*

Our additional 9 cases are as follows:

CASE VIII.—*Typhoid, diagnosis perforation; no perforation or other lesion found. Recovery.*

Male, white, laborer, aged nineteen years; hospital No. 1292; admitted July 18, 1905, on the eleventh day of the disease.

Patient had been quite ill, very toxic, moderate delirium during most of his illness. On the twenty-third day he had sudden abdominal pain, a chill, two degrees elevation of temperature, pulse jumped from 104 to 168 and respirations from 28 to 34. When seen an hour later, there was moderate tenderness and rigidity over the right rectus, expression drawn and anxious, was perspiring, pulse very rapid and weak, his legs and thighs were flexed, and it was thought that he had typhoid perforation. Was seen by a surgeon, operation advised and done 3 hours after onset of pain under ether anæsthesia. Intestines were examined carefully for perforation but none found. There was no evidence of peritonitis and nothing else abnormal was revealed. The wound was closed without drainage. After the operation the course of his typhoid seemed uninterrupted and he was profoundly toxic. On the fourth, fifth, and sixth days after operation he had chills; blood examination for malaria negative; no infection of the wound, cause of chills not determined. Sixteenth day after operation his temperature became normal and he was thought to be convalescent, but soon developed a swelling and tenderness over the sternoclavicular joint. After this he made an uneventful recovery but was operated upon for an incisional hernia before his discharge from the hospital.

Case IX.—*Typhoid, diagnosis perforation. Operation, no perforation or other lesion found. Recovery.*

Male, white, stone-cutter, aged twenty-one years; hospital No. 1570; admitted August 9, 1905. Patient was ill one week before admission to the hospital, began with a chill, headache, slight diarrhœa, and vomiting. He had a moderately severe infection with a positive Widal and 5300 leucocytes. Six days after admission he complained of slight abdominal pain. At this time his abdomen was perfectly soft, no distention, and free from tenderness. On the tenth day after his admission, at 4 o'clock in the morning, he cried out with sudden pain in the abdomen. Half an hour later he had a chill, the abdomen was quite rigid on both sides, but the liver dulness was not obliterated. There was no distention and on auscultation no peristalsis was heard. Pulse became more rapid and weak and respirations increased. One hour later temperature had risen, his abdomen was softer, there was less rigidity, and he was seen by a surgeon at this time, who thought operation was indicated. It was done under ethyl-chloride-ether anæsthesia, right rectus incision. There was a small amount of moderately fetid smelling turbid fluid which escaped on opening the peritoneum. Numerous thickened ulcers were seen, but careful examination did not reveal any perforation. The abdomen was irrigated with salt solution and drained

with gauze. Shortly after the operation his pulse jumped to 160, was of very poor quality, and he was given a hypodermoclysis of salt solution under both breasts. After this he did well and made an uneventful recovery.

CASE X.—*Typhoid, diagnosis perforation. Operation, no perforation found but retroperitoneal cellulitis. Death.*

Male, white, hat-worker, aged twenty-nine years; hospital No. 3356; admitted January 22, 1906. Patient came into the hospital complaining of having been sick for three weeks; headache, loss of appetite, constipation, and general weakness. Illness began with a chill. On admission the abdomen was soft, no tenderness or rigidity, his liver dulness was apparently normal, and his spleen was not palpable. Day after admission complained of much severe abdominal pain after an enema. Pain was cramp-like in character, persisted and became worse with repeated vomiting. His abdomen was generally tender, slightly rigid, tenderness more marked in the left iliac fossa. Abdomen not distended. No mass could be felt. The patient's general condition was good. His pulse rate had not changed. Under ethyl-chloride-ether anæsthesia the abdomen was opened through the right rectus and a general peritonitis found. No perforation could be found after a careful search, but back of the peritoneum, extending along the side of the ascending colon and walls of pelvis, there seemed to be an inflammatory mass with a probable purulent collection. There was some lymph around the appendix and cæcum. This mass seemed to extend toward the perineum and a perineal incision was made and a rubber tube introduced for drainage. Patient stood the operation well but vomited a few hours later, became rapidly worse, and died the next day. Autopsy: Many ulcers were found in the small intestine; the bladder was found to be very small and thick. Back of the peritoneum, dissecting up the colon, and extending up to the kidney, was found a large collection of purulent fluid, the origin of which was not determined. The retroperitoneal tissues were very œdematous.

CASE XI.—*Typhoid, diagnosis perforation. Operation, no perforation or other lesion found. Death 12 hours later. No autopsy.*

Male, white, laborer, aged thirty years; hospital No. 1194; admitted July 10, 1906, on the fourth day of typhoid, positive Widal, leucocytes 3900, rather severe infection with temperature ranging between 102° and 105°. He did well excepting for toxæmia until the fourteenth day, when after a tub he had a chill, pulse became very rapid and weak, abdominal pain, tenderness and rigidity with distention developed. Was seen by a surgeon, who advised operation for a probable perforation. Under ethyl-

chloride-ether anæsthesia the abdomen was opened through a right rectus incision, there was no perforation, and the wound was closed. The patient was returned to the ward without any apparent ill effects from the operation. Twelve hours later he suddenly became very much worse and died. No autopsy.

CASE XII.—*Typhoid, diagnosis possible perforation. Operation, no perforation found but enlarged mesenteric glands. Recovery.*

Female, white, cook, aged twenty-nine years; hospital No. 1986; admitted September 21, 1906, on the tenth day, of a rather severe typhoid; Widal positive, leucocytes 2050, the abdomen was distended from the time of admission, and temperature ranged from 103° to 104°. Her temperature became normal on the twenty-first day and convalescence was established. Eight days later she complained of soreness of the abdomen on palpation, there was found to be marked tenderness along the right rectus and most marked in the right iliac fossa, but the tenderness extended well up into the right hypochondriac region. No mass was felt, liver dulness was unchanged, and her chest was clear. Temperature went to 100, leucocytes, 4 hours after onset of pain, were 4900 and 8 hours after were 4500. Vaginal examination was negative. Both physician and surgeon thought exploration of the abdomen was advisable, although they did not think perforation had occurred; they could, however, not exclude it. Operation under ethyl-chloride-ether anæsthesia, right rectus incision. Careful exploration did not reveal any perforation but there was much swelling of the mesenteric glands. The abdomen was closed without drainage and the patient made an uneventful recovery.

CASE XIII.—*Typhoid, diagnosis perforation. Operation, no perforation found but typhoid ulceration of the appendix. Death from general peritonitis 6 days later.*

Male, white, iron-worker, aged twenty-six years; hospital No. 846; admitted June 23, 1907, on the seventh day of his illness. He had had headache and anorexia, and complained of severe muscular pains, especially in his legs and back. Stopped work June 19. He ran a rather typical course of typhoid with a positive Widal, and his leucocytes on three different occasions were between 9000 and 10,000. About the nineteenth or twentieth day of the disease he developed slight abdominal pain, confined to the right lower quadrant, without nausea, and considerable tenderness with rigidity of the right rectus. He was seen by the attending physician and surgeon who thought he might have a typhoid perforation. There had not been any marked change in his pulse or general condition. He was operated upon under ethyl-chloride-ether anæsthesia, right rectus incision. The intestine was care-

fully searched for perforation, which was not found, although many typhoid ulcers were found. The appendix showed decided inflammatory changes, enough it was thought to have accounted for his condition. It was removed and the stump inverted in the usual manner. The abdomen was closed without drainage. He did well for 5 days, when his abdomen became distended, he grew rapidly worse, and died on the sixth day after operation. Autopsy showed general peritonitis without perforation of the intestine but with many typhoid ulcers in the ileum. Examination of the appendix showed rather deep ulceration which seemed to be of typhoidal origin.

CASE XIV.—*Typhoid, diagnosis perforation. Operation, no perforation or other lesion found. Recovery.*

Male, white, press-feeder, aged twenty years; hospital No. 1515; admitted August 25, 1907, on the twenty-fifth day of a moderate infection with a positive Widal and 7750 leucocytes. His fever was never very high (101° to 103°), but persistent, and he was not very toxic. On the fifty-third day of the disease he suddenly cried out with pain in the lower abdomen, more marked in the right iliac fossa. Pain increased on deep inspiration. On palpation there was rigidity of the right rectus and moderate tenderness. Pulse, respirations, and temperature were unchanged. His leucocytes were 9050 shortly after the onset of pain. Two hours later he was operated upon under ethyl-chloride-ether anæsthesia, right rectus incision. There was no peritonitis or free fluid. Intestines were examined carefully for perforation but none found. There were apparently many deep typhoid ulcers in the ileum. The abdomen was closed. The patient's temperature continued slightly elevated for two weeks after the operation, after which it became normal and he was discharged 27 days after operation, cured.

CASE XV.—*Typhoid, diagnosis perforation. Operation, no perforation or other lesion found. Recovery.*

Female, white, seamstress, aged fifteen years; hospital No. 1640; admitted August 31, 1908, on the sixteenth day of a severe infection with a positive Widal and 6000 leucocytes. On the twenty-second day her temperature dropped to normal and her pulse to 88. Soon after this she had a chill, her temperature rose to 104.3°, her pulse in 3 hours jumped to 164 (?), and her respirations from 24 to 44. She had abdominal tenderness and rigidity, she was very much shocked, was given stimulation, and two hours later her condition was very much better. Leucocytes were 4300. Operation advised and done under ether anæsthesia, median incision, the large and small intestines being carefully

explored but no perforation found. The gall-bladder, appendix, and spleen were also explored but nothing abnormal found. The mesenteric glands were enlarged but there was very little ulceration of the intestines. The wound was closed and the patient reacted promptly from the operation. Her fever continued 34 days after operation, but was very slight (100° to 101°). After this she made an uneventful recovery and was discharged cured.

CASE XVI.—*Typhoid, diagnosis probable appendicitis. Operation, thickened and ulcerated ileum found, pre-perforative stage. Recovery.*

Male, aged twenty years; hospital No. 2392; admitted October 28, 1910, with a typical attack of typhoid fever, probably at the end of the first week of his disease. On about the fourteenth day he complained of a great deal of pain in his abdomen and a small tender mass could be felt in the region of the appendix. With this he had a slight elevation of temperature, but no increase in leucocytes. There was little or no rigidity, but considerable tenderness in the region of the appendix. The existence of a mass at this time was doubtful. Twenty-four hours later a mass, which seemed movable, could be distinctly felt in the right iliac fossa. He still complained of pain, there was no rigidity, and there was little change in his general condition from the day before. Attending surgeon was sure that he had not a perforation, but felt that he probably had an appendicitis and advised operation. The abdomen was opened through a small Kammerer incision under morphia-ethyl-chloride anæsthesia. The mass which was felt was the last two inches of the ileum, which was the seat of numerous ulcers, and was enormously thickened. One of these ulcers was very thin and was in the pre-perforative stage. This was covered by the passage of a purse-string suture. The appendix was normal. The abdomen was closed without drainage and he recovered.

The most striking feature of these 16 cases is that in but 2 did death follow an exploration in typhoid fever, where no cause for the symptoms could be found at operation. Five such operations were followed by recovery. In 2 of these cases it is probable that the symptoms which seemed to indicate operation were due to pneumonia. In 3 of the 16 cases acute appendicitis was found, 1 patient died from pneumonia, 1 from peritonitis, and 1 recovered. In another case, hemorrhage probably produced the symptoms suggesting perforation. This case also recovered. A suggestive case in this group is the one in which pain, tenderness, and rigidity were due to salt solution introduced into the abdominal wall. Another interesting case is the one in which a diag-

nosis of acute appendicitis was made and in which a pre-perforative stage of ulceration was found.

I think that a review of these cases goes to show that but few unnecessary operations have been performed and that in these few the mortality is surprisingly low. Out of 16 cases, 10 recovered and 6 died; but in the latter were but 2 cases in which no lesion justifying operation was found. In this connection it may be well to say that in many of the cases where perforation was found, the indications for operation were less definite than in these cases and that we are dealing with a condition which, if we wait until the signs of perforation are absolutely positive, we will save but few patients.

Next let us examine the cases in which no operation was done but the perforation found at autopsy. A synopsis of their histories is given later. There are of these 27 cases presenting some interesting features. In the first place, but one patient died, refusing operation, although delay in obtaining consent was frequent throughout the whole series. In 7 cases perforation was suspected but no operation was done, because the patient's condition was considered to indicate a rapidly approaching death and the uselessness of operation. Lung conditions, varying from a bronchitis to tuberculosis with gangrene of the lung, constitute the cause of error in a large number of the cases. In reviewing all the cases it is quite remarkable how seldom operation was done for perforation when a lung condition was responsible for the symptoms and how frequently a lung condition caused us to attribute the abdominal symptoms to it when perforation was also present.

Hemorrhage was frequent in many of the undiagnosed cases and undoubtedly contributed to the error. In but 3 instances is the failure to recognize a perforation attributed to delirium and profound toxæmia.

I should say that the two practical lessons to be derived from a study of these 27 cases is that we must not forget that a pneumonia and a perforation frequently coexist and that the same is true of hemorrhage and perforation.

CASES OF PERFORATION OPERATED UPON OR FOUND AT AUTOPSY

The notes of the first 50 cases will not be recorded here as they have already been reported in Scott's paper.

CASE LI.—*Perforation. Operation, and death 6 days after operation.*

Male, white, aged seven years; hospital No. 1694; admitted August 22, 1904, on the fourteenth day of a moderately severe infection, with a positive Widal, 8,000 leucocytes, temperature ranging about 103°, no complications, and no pronounced toxæmia. On the thirtieth day of his illness he developed sudden severe pain in the epigastrium and right iliac fossa with a rapid weak pulse (last record before attack 120, jumped to 150?), costal breathing, respirations increased from 26 to 32, and signs of collapse. Four hours after much abdominal tenderness, pronounced general rigidity, more marked over right rectus, with vomiting and several small bowel movements, and with increasing picture of peritonitis. Operation four hours after onset of pain, ethyl-chloride-ether anæsthesia, right rectus incision. One perforation found, pinhead in size, in ileum a few inches above ileocæcal valve which was sutured and gauze drainage institutted. Death six days later, which was ascribed to inanition, as he did not show signs of peritonitis. Culture from abdominal fluid at time of operation sterile at the end of 48 hours.

CASE LII.—*Perforation. Operation. Death. Autopsy.*

Female, white, housework, aged twenty years; hospital No. 1983; admitted September 17, 1904, on the fourteenth day of a severe infection with a negative Widal and 6400 leucocytes. Toxic from the time of admission. Complained of pain, but not severe, on the twentieth day, with tenderness, but without rigidity and without any marked change in general condition, except a slightly accelerated pulse. On the twenty-first day had sudden severe pain, after sitting up in bed, referred to right iliac fossa, with shock and collapse, pulse almost imperceptible (140 to 160?), respirations increased from 40 to 56, and temperature rose 3.2 degrees, cyanotic, with great tenderness and generalized rigidity of whole abdomen, with more tenderness on right than on left side. Liver dulness obliterated. Operation, ethyl-chloride-ether anæsthesia six hours after onset of pain. Perforation found about the size of a goose-quill several inches above the ileocæcal valve with plastic peritonitis and much soiling of the peritoneum. Perforation sutured, gauze drainage, death 8 hours later, never fully reacted. Autopsy revealed second perforation near cæcum, size not stated.

CASE LIII.—*Perforation. Operation. Secondary perforation and operation. Death. Autopsy.*

Male, white, paperhanger, aged eighteen years; hospital No. 2117; admitted September 28, 1904, on the seventh day of a severe infection, with a positive Widal and 9200 leucocytes. Had distention with slight persistent pain from time of admission. On

the eleventh day this gradually became more severe with slight paroxysms referred to the right iliac fossa without marked change in general condition, except slightly increased pulse rate, moderate tenderness and rigidity of rectus, right more pronounced. Six hours later he had a sudden severe outburst of pain, marked tenderness all over the abdomen with great rigidity and signs of collapse. Operation (soon after), ether anæsthesia, perforation sutured, gauze drainage after flushing abdominal cavity with salt solution. There had been no marked change in pulse, temperature or respirations. Reacted pretty well. Did well for 5 days when he had a chill without much pain but with increased rigidity and failure in general condition. Under ethyl-chloride anæsthesia the former drains were removed, intestines examined, and small perforation found near original (a little nearer the cæcum). This was sutured and gauze drainage instituted again. Death occurred the third day after the second operation. Autopsy: Localized peritonitis, fecal fistula at site of second operation without any other perforation. Death in history ascribed to toxæmia, as peritonitis was plastic and confined to coils immediately about perforation.

CASE LIV.—*Perforation. Operation. Death.*

Female, white, seamstress, aged sixteen years; hospital No. 393; admitted December 31, 1904, on the eighth day of a moderately severe infection, with a positive Widal and 4850 leucocytes. Abdomen slightly distended from time of admission, but patient never complained of pain or tenderness until the sudden onset of severe generalized pain followed by chill on the nineteenth day. The pulse became weak and rapid, 108 to 140, respirations increased from 24 to 40, with 3.3° elevation of temperature. Two hours after onset of pain leucocyte count 7500 and 5 hours later 10,850. The abdominal respiratory movements were limited to the upper part of the abdomen. Patient restless, with an anxious expression. There was marked tenderness over both lower quadrants (right more marked) with rigidity of both recti. Liver dulness at this time unimpaired. Seven hours later abdomen more tender, rigidity more marked, expression pinched, pulse running and poor, liver dulness almost obliterated, tympany over anterior axillary line to fourth rib. Operation, right rectus incision, pin-head perforation about 4 inches above the ileocæcal valve, sutured, free fecal matter in cavity, irrigated with salt solution, gauze drainage. Death 30 hours later, autopsy refused.

CASE LV.—*Perforation. Operation. Death. Autopsy.*

Male, white, laborer, aged thirty years; hospital No. 3512; admitted February 4, 1905, on the fourteenth day of a mild infec-

tion, with a negative Widal and 3600 leucocytes. He seemed to be convalescent on twentieth to twenty-fourth day, when his temperature again went up, ranging about 103° (higher than before), pulse 108 to 140, respirations 24 to 32 until the thirty-fifth day when he complained of pain, not severe, which gradually got worse. On examination tenderness and rigidity were found and liver dulness was obliterated, except in posterior axillary line. At onset of pain there was an immediate 3° drop in temperature with a 3.3° subsequent elevation. Pulse rapid and of poor quality. Operation 3 hours later, local anæsthesia, perforation 1½ cm. in size, 43 cm. above the ileocæcal valve, perforation closed, gauze drainage, general peritonitis. Death 15 hours later. Autopsy, diffuse purulent peritonitis, marked congestion of lungs, cloudy swelling of heart, liver and kidneys. Marked ulceration of ileum, cæcum, and colon. No other perforation.

CASE LVI.—*Perforation. Operation. Death.*

Male, white, metal-worker, aged thirty years; hospital No. 4206; admitted March 28, 1905, on the fourth day of disease, with a positive Widal and 8400 leucocytes. Seemed to have a rather severe infection, temperature ranging from 103° to 104°, requiring persistent sponging, but was uncomplicated to the eighteenth day, when he complained of lower abdominal pain (not severe) which persisted all night. Slight tenderness and rigidity over both lower quadrants (right more marked). Twelve hours later pain became very severe, marked generalized rigidity, costal breathing, pronounced tenderness all over the abdomen but more marked in the right lower quadrant, no marked change in pulse and respirations, but temperature dropped from 100.2° to 96.2°, with a subsequent rise to 101.2°, peristalsis almost absent, abdominal breath sounds and liver dulness almost obliterated. Operation, ethyl-chloride-ether anæsthesia, median incision, peritonitis, much soiling and leakage into the peritoneal cavity. Perforation 3 mm. in diameter was found in the ileum 25 cm. above the ileocæcal valve, sutured, abdomen flushed, gauze drainage. Death a few hours later without reaction. No autopsy.

CASE LVII.—*Perforation. Operation. Death. Autopsy.*

Male, white, laborer, aged thirty-five years; hospital No. 635; admitted May 23, 1905, on the twentieth (?) day of disease. No record of Widal or leucocyte count. Patient was admitted with a temperature of 103° and definite symptoms of peritonitis with a history of fever for 18 or 20 days, which seemed to be enteric. "Has had abdominal pain most of this time which has been severe during the last 10 hours." Operation, ethyl-chloride anæsthesia, right rectus incision. General peritonitis, much free purulent

fluid, perforation size of a pea in ascending colon 10 inches above the ileocæcal valve, closed with silk, gauze drainage. Reaction poor, death 24 hours later. Autopsy: Acute purulent peritonitis, cloudy swelling of heart, liver, and kidneys. Acute bronchopneumonia. Extensive ulceration of ileum and ulceration of colon. No other perforation.

CASE LVIII.—*Perforation. Operation. Death. Autopsy.*

Male, white; hospital No. 789; admitted June 6, 1905, on the sixth (?) day of a mild infection, with a negative Widal and 6500 leucocytes, which later increased to 13,000. Patient says that he has only been sick 6 days with headache, fever, and abdominal pain. Temperature on admission was 102°, after this it was never above 100.2°, showing a subsiding tendency, and was practically normal on the eighth day, when he suddenly developed severe abdominal pain, legs flexed, generalized tenderness and rigidity, which was marked over right lower quadrant, and costal breathing. Heart and lungs negative. Peristalsis everywhere audible. Operative permission refused until 7 hours later. Operation, ethyl-chloride-ether anæsthesia, median incision, perforation found 6 inches above the ileocæcal valve and closed. Another pre-perforative ulcer was invaginated. Reacted well and did well for 2 days, when the tenderness and rigidity increased and he died 30 hours later. Autopsy: Peritonitis, with another perforation beside the original.

CASE LIX.—*Perforation. Death. Autopsy.*

Male, white, machinist, aged twenty-six years; hospital No. 1068; admitted June 30, 1905, on the seventh day of a severe infection with a positive Widal and 11,050 leucocytes. Patient was very sick from time of admission, profound toxæmia, and hyperpyrexia. Temperature 103° to 105°. On the twelfth day after a tub his pulse became very rapid with circulatory failure and marked cyanosis, pulse increased from 128 to 156 (?). Previous to this had delirium and marked subsultus and profound toxæmia with stupor for 3 or 4 days. Death 12 hours later, evidently perforation was not suspected. Autopsy: Recent diffuse peritonitis, marked ulceration of the ileum, perforation, 1 mm. in diameter just above the cæcum, cloudy swelling of heart, liver, and kidneys. Congestion of the lungs.

CASE LX.—*Perforation. Death. Autopsy.*

Male, white, weaver, aged twenty-seven years; hospital No. 1329; admitted July 20, 1905, on the fourth day of relapse, with a positive Widal and 4900 leucocytes. Had been sick with typhoid for 4 weeks, after which his temperature was normal for several days before his admission to the hospital. Seemed very sick on

admission, developed coma vigil and became very toxic. On the sixth day became worse, small hemorrhage with profuse hemorrhage on the seventh day, for which intravenous salt infusion was done. Pulse rapid and weak, considerable abdominal distention, did not complain of pain or tenderness but slight rigidity on the eighth day. Death on tenth day. No note of suspicion of perforation. Autopsy: Marked ulceration of ileum with ulceration of colon and rectum. General peritonitis. Perforation of ileum. Bronchopneumonia. Cloudy swelling of kidney and liver. Dilatation of right heart.

CASE LXI.—*Perforation. Operation. Death. Autopsy.*

Female, white, aged six years; hospital No. 1470; admitted August 1, 1905, on the seventh day of disease, with a very suggestive Widal and 14,900 leucocytes. Patient and her father were admitted together, with typhoid. Ran a rather severe uncomplicated course until about the fourteenth day, when she was seized with severe pain (crying out) in the abdomen, expression anxious, with lower abdominal rigidity (more marked over right lower quadrant) and tenderness. No marked change in general condition, perforation diagnosed, permission for operation refused. She steadily grew worse with increasing signs of peritonitis. Operation 24 hours later, chloride of ethyl ether anæsthesia, general peritonitis, perforation found 2 mm. in diameter, 11 cm. above the ileocæcal valve and sutured, another pre-perforative ulcer invaginated, salt irrigation, gauze drainage, death a few hours later. Autopsy through wound, general peritonitis, but no other perforation.

CASE LXII.—*Perforation. Death. Autopsy.*

Male, white, laborer, aged twenty-nine years; hospital No. 1890; admitted September 7, 1905, on the seventh day of a severe infection, with a positive Widal and 8400 leucocytes. Patient became very sick after the twelfth day, marked toxæmia and three hemorrhages on seventeenth and eighteenth days. Marked circulatory failure with delirium. Died on the twentieth day. Perforation was probably not suspected. Autopsy: General peritonitis, typhoid ulceration of bowel with a very small perforation of the ileum, 30 cm. above the ileocæcal valve, and another, pinhead in size, 50 cm. above the ileocæcal valve, acute splenic tumor, cloudy swelling of heart, liver, and kidneys, congestion of the lungs, fibrous pleurisy.

CASE LXIII.—*Perforation. Death. Autopsy.*

Male, white, laborer, aged twenty-seven years; hospital No. 1980; admitted September 17, 1905, on the fourteenth day of a

moderate infection, with a positive Widal and 4300 leucocytes. A suspicion of tuberculosis in both apices (repeated examinations of sputum for tubercle bacilli made with a negative result), and a few days after admission developed a diffuse bronchitis with repeated hæmoptysis for several days, without evidence of pneumonic consolidation. Temperature became lower and was practically normal on twenty-first to twenty-third days. Slight fever again, 100 to 101°, and was again normal on the twenty-ninth day. Slight abdominal pain with elevation of temperature on thirty-third day, became rapidly worse with abdominal tenderness, distention, and rigidity, and died a few hours later. His pulse increased from 80 to 120 within a period of 5 hours. No change in respirations. No note indicating that perforation or operation was considered. Autopsy: Acute purulent peritonitis, cloudy swelling of heart, liver, and kidneys. Typhoid ulceration of ileum and colon, with perforation 1 cm. in diameter in descending colon, and echinococcus cyst of left lung.

CASE LXIV.—*Perforation. Operation. Death.*

Male, white, printer, aged twenty-eight years; hospital No. 2974; admitted December 21, 1905, on the seventh day of disease, with a severe infection, a positive Widal, and 1050 leucocytes. Had had typhoid 8 years before and was confined to bed two months with it. Patient was very sick from the time of his admission, pronounced toxæmia, five hemorrhages from fourteenth to eighteenth days, totalling 63 ounces, condition very poor. On eighteenth day became worse, with tenderness in the right iliac fossa, increased distention without pain or rigidity. No change in liver dulness. After a few hours' interval tenderness had increased with slight rigidity, but no active pain. Perforation diagnosed. Operation, ethyl-chloride-ether anæsthesia, a very small recent perforation found about 12 inches above the ileocæcal valve which was closed and another pre-perforative ulcer was invaginated. No peritonitis, very little soiling of cavity, no drainage. Owing to poor condition shock of operation marked, never regained consciousness, death resulting in a few hours.

CASE LXV.—*Perforation. Operation. Death.*

Female, white, housework, aged twenty-one years; hospital No. 3587; admitted February 13, 1906, on the fifth day of a moderately severe infection which became protracted, with a positive Widal and 3500 leucocytes. Had moderate distention after admission but was uncomplicated until thirty-third day, when she complained of rather severe abdominal pain, had a chill with marked acceleration of pulse (92 to 140), respiration 20 to 28, and a 3-degree elevation of temperature. Pain was in the region

of the bladder and she had frequent micturition with vesical tenesmus. Lower abdomen became rigid and she vomited. Was catheterized, 18 ounces obtained, which seemed to relieve the pain. During the next 24 hours not much change in condition. Abdominal symptoms not marked. Operation 48 hours after onset of pain, ethyl-chloride-ether anæsthesia, right rectus incision, general purulent peritonitis, and perforation found ⅛ of an inch in diameter 3½ feet above the ileocæcal valve which was closed; gauze drainage, Murphy treatment instituted. Two days later vomiting, great distention, and death on the third day after operation. No autopsy.

CASE LXVI.—*Perforation. Death. Autopsy.*

Female, colored, housework, aged thirty years; hospital No. 3658; admitted February 19, 1906, on the twenty-first day of the disease, with a severe infection, a positive Widal, and 6200 leucocytes. Was profoundly toxic with irregular remitting temperature most of the time. On twenty-third day she suddenly became worse, pulse could not be counted with accuracy (went from 120 to 140?), abdomen distended, no note of pain, tenderness, or rigidity. Perforation not suspected. Increasing toxæmia and death on the twenty-fifth day. Autopsy, typhoid ulceration of ileum and colon, one perforation, 1 cm. in diameter, found 50 cm. above the ileocæcal valve and a second large perforation found a "little nearer" the ileocæcal valve. Cloudy swelling of heart, liver, and left kidney. Diffuse purulent peritonitis, thrombosis internal iliac vein and acute bronchopneumonia.

CASE LXVII.—*Perforation. Death. Autopsy.*

Female, white, housework, aged twenty-one years; hospital No. 3679; admitted February 21, 1906, on the ninth day of disease, with mild infection, a positive Widal and 6800 leucocytes. This patient ran a mild course until the sixteenth day when she began to have hemorrhages. On the eighteenth day she had 9, varying in amounts of 4 to 16 ounces. During this 12 hours she had 4 pints of salt solution intravenously at one time, and 3½ pints at another time. Before this she was almost exsanguinated. Improved after salt solution and had no more hemorrhages. Pulseless before infusion. Pulse 3 days later (twenty-first day), 120 to 128, when she developed abdominal pain, tenderness, and rigidity in right rectus; expression pinched, no marked circulatory change. Twenty-four hours later vomited, pulse 120 to 140. On twenty-third day vomited all nourishment, "fecal in odor once," no pain. Twenty-fifth day, occasional vomiting, good bowel movement, pulse 128 to 150, better quality, no abdominal pain or tenderness. No abdominal tenderness or dis-

tention with two or three formed bowel movements. Twenty-seventh to thirty-first day she became much worse with signs of bronchopneumonia, and died on the thirty-second day. Autopsy: Diffuse purulent peritonitis, perforation about 1 mm. in diameter and 10 cm. above the ileocæcal valve, extensive ulceration of the ileum and cæcum. Cloudy swelling of heart, liver, and kidneys. Bilateral purulent pyelonephritis, purulent cystitis, broncho-pneumonia, and thrombosis of both internal iliac veins.

CASE LXVIII.—*Perforation. Operation. Death.*

Male, white, bell-boy, aged sixteen years; hospital No. 3735; admitted February 26, 1906, on the sixth day of disease, with a severe infection, a positive Widal, and 10,100 leucocytes. Leucocytes on the ninth day were 8900, on the eighteenth day 14,600, on the twentieth day 15,700 by two counts. Complained of pain in delirium, diffuse tenderness over lower abdomen, marked distention. Slight rigidity 12 hours before operation which increased, diminished peristalsis, audible abdominal breath sounds, obliterated liver dulness, cyanosis, gradual shock. Operation, local and ethyl-chloride-ether anæsthesia, perforation, one-eighth of an inch in diameter and about 10 inches above the ileocæcal valve, sutured, abdomen irrigated, gauze drainage, enteroclysis and elevation. Did well for two days after operation, abdomen became soft and no longer distended. Suddenly became worse, abdominal pain, rigidity, distention, collapse, and death at end of third day. No autopsy (probably, a second perforation).

CASE LXIX.—*Perforation. Operation. Death. Autopsy.*

Male, white, laborer, aged thirty-two years; hospital No. 3753; admitted February 27, 1906, on the ninth day of disease with a moderately severe infection, a very suggestive Widal, and 4000 leucocytes. On twenty-second day leucocytes were 8400, and twenty-fifth day, just before operation, 7100. On admission patient complained of right iliac pain and tenderness, had some rigidity at this time which was thought to be voluntary. Had persistent febrile course, 102 to 104°, without severe toxæmia. Temperature normal on twenty-third day, remaining 97 to 98.2° after this. Patient complained daily of pain in the abdomen which he referred to the right iliac fossa. Was always tender and slightly rigid over this area from time of admission. His pulse was 84 to 112 from the twenty-third to the twenty-sixth day, with temperature normal, but he persistently complained of pain and tenderness. On the twenty-sixth day his condition became worse, without elevation of temperature, and he was operated upon, ethyl-chloride-ether anæsthesia, right rectus incision. Cloudy fluid on opening the peritoneum, seemed to have

a walled-off leaking abscess, which was drained without breaking adhesions to locate perforation. Five days later free fecal discharge from wound, temperature normal and subnormal, pulse 120, not doing well. Death suddenly on the seventh day after operation. Death thirty-second day. Autopsy: General fibrinopurulent peritonitis, ulceration of the ileum and jejunum, two small perforations, the first at the junction of the ileum and jejunum, and the second in the jejunum just above the juncture, swelling of mesenteric lymph-glands, acute vegetative endocarditis, cloudy swelling of liver and kidneys, chronic perisplenitis, chronic adhesive pleurisy.

CASE LXX.—*Perforation. Death. Autopsy.*

Male, white, watchman, aged forty-three years; hospital No. 4098; admitted March 29, 1906, on the fourteenth day of disease with a severe infection, a positive Widal, and 3300 leucocytes. Leucocytes at supposed time of perforation were 7600. Patient very sick from time of admission with repeated hemorrhages, fourteenth to eighteenth days, totaling nearly 80 ounces. Condition very poor after this. Had signs of considerable bronchitis and possible bronchopneumonia after this, and on thirty-second day began to complain of pain, abdomen tender, rigid, and distended, with rapid circulatory failure. On thirty-third day perforation was diagnosed but too weak for operation. Death 12 hours later. Autopsy: General peritonitis, perforation of ileum, cloudy swelling of heart, liver, and kidneys, lobar pneumonia left base, and fibrinopurulent pleurisy.

CASE LXXI.—*Perforation. Operation. Death.*

Male, colored, laborer, aged twenty-seven years; hospital No. 4450; admitted April 24, 1906, on the twelfth (?) day of the disease, with a severe infection, a suggestive Widal, and 4600 leucocytes. Later leucocytes were 6950. On admission (48 hours before operation) complained of abdominal pain, tenderness in the right iliac fossa, abdominal distention and liver dulness almost obliterated. These symptoms persisted. Had another attack of pain 24 hours after admission with increasing toxæmia. Says abdomen feels as if splinter was being stuck in over McBurney's point. Liver dulness absent in nipple line (8 hours after admission). Patient had urinary difficulty to-day, has vomited two or three times with rapid pulse, rise of temperature, and increasing toxæmia. Patient had two hemorrhages before admission and two after admission. Operation, ethyl-chloride-ether anæsthesia about 60 hours after admission, three perforations, the first pin-point in size and 12 inches from the ileocæcal valve, the

second, 2 mm. in size and 15 inches from the ileocæcal valve, and the third, 6 mm. in size and 24 inches from the ileocæcal valve. General peritonitis, marked effusion of intestinal contents, perforations sutured, gauze drainage, Fowler position, enteroclysis. First perforation probably 48 hours before operation, large perforation probably at time of vomiting, just before operation. Death 4 hours later. No autopsy.

CASE LXXII.—*Perforation. Operation. Death. Partial autopsy.*

Male, white, laborer, aged twenty years; hospital No. 643, admitted May 26, 1906, with a severe infection, a positive Widal, and 7700 leucocytes. Leucocytes 5 hours after pain 15,900; 6 hours after, 16,300. This patient was admitted on the sixth day of disease, had sudden recurrent paroxysms of pain with abdominal tenderness which persisted between paroxysms, with persistent desire to urinate. Right lower rectus rigidity which gradually increased. Peristalsis lessened, audible abdominal breath sounds. Shock attended onset of pain and was attributed to tub which was being given at onset of pain. No vomiting. Operation refused at first but was done 10 hours after pain, ethyl-chloride-ether anæsthesia. Perforation, pin-head in size, found 15 inches from cæcum and closed, gauze drainage, moderate extravasation of intestinal contents, cavity irrigated. Patient did well from surgical stand-point, but died 7 days after operation from toxæmia and pneumonia. Autopsy through wound: Perforation had healed, peritonitis had subsided, and no other perforation had occurred.

CASE LXXIII.—*Perforation. Operation. Death. Autopsy.*

Male, white, policeman, aged forty years; hospital No. 737; admitted June 3, 1906, on the tenth day of disease, with an ambulatory infection, positive Widal, and 7280 leucocytes, counted just before operation. Patient said he had had a cold for 10 days, no diarrhœa, epistaxis or chills. Thirty-six hours before admission severe headache, general weakness, pain in abdomen, and vomiting when he went to bed. Referred to the hospital as appendicitis. Abdomen slightly distended with generalized tenderness and rigidity, more marked in the right iliac fossa. Operation, ethyl-chloride-ether anæsthesia, right rectus incision, purulent peritonitis with much fecal matter, perforation, 2 mm. in size and about 5 inches above the ileocæcal valve, closed, salt solution irrigation, rubber tube and gauze drainage. Death 15 hours later. Autopsy: Typhoid ulceration of bowel, general peritonitis, no other perforation.

CASE LXXIV.—*Perforation. Operation. Death.*

Male, white, laborer, aged thirty-five years; hospital No. 1035, admitted June 28, 1906, with a history of having been sick 9 days with headache, fever, and abdominal pain. Epistaxis and cough. Two days before admission patient was seized with severe cramp-like abdominal pain and vomiting. On admission abdomen was greatly distended with diffuse tenderness and marked generalized rigidity. No record of Widal or leucocyte count. Operation soon after admission under ethyl-chloride-ether anæsthesia, right rectus incision. On opening the peritoneum there was a free escape of purulent material mixed with fecal matter. A small perforation was found in the ileum a few inches above the ileocæcal valve and was closed with a purse-string suture. Gauze drainage instituted, abdomen partially closed, patient gradually failed and died 24 hours later.

CASE LXXV.—*Perforation. Operation. Recovery.*

Male, white, bartender, aged nineteen years; hospital No. 1601; admitted August 14, 1906, on the seventh day of a moderately severe typhoid with a positive Widal and 8800 leucocytes. He had moderate distention of the abdomen soon after admission but the course of the disease was uncomplicated up to the twentieth day, when, after a good night, and immediately after taking a drink of water, he had severe sharp pain in the abdomen with a chill, rapid weak pulse, tenderness in the left iliac fossa, slight muscular rigidity, audible breath sounds over the abdomen, diminished peristalsis with costal breathing, and 50 per cent. increase in his respiratory rate with considerable shock. His temperature immediately dropped 3 degrees with a secondary rise. Leucocyte count at the onset of pain was 5700, two hours later, 4800, three hours after onset of pain, 4100, and four hours after onset of pain, 7200. Operation 4 hours after onset of pain under ethyl-chloride-ether anæsthesia, right rectus incision. On opening the peritoneum it was found there had been considerable escape of intestinal contents. A perforation was found, pin-head in size, in the ileum, 11 inches from the ileocæcal valve. It was closed, the wound drained with gauze and Murphy treatment instituted. Stood the operation well. His leucocytes were counted 3 hours after the operation and were 6300, 6 hours after operation they were 7400, 8 hours after operation they were 8500. On the fifth day after operation he had a hemorrhage of 9 ounces from the bowels. His temperature continued irregular but not high for 17 days after the operation. After this his recovery was uneventful.

CASE LXXVI.—*Perforation. Operation. Death.*

Male, white, laundryman, aged thirty-seven years; hospital No. 1618; admitted August 16, 1906, on the fourteenth day of a rather severe infection with a positive Widal and 4200 leucocytes. There were no complications until the thirty-fourth day, but during all this time his temperature had been moderately high and persistent. On the thirty-fourth day he developed severe abdominal pain, his pulse was almost imperceptible, and he had a severe chill, with considerable shock. His respirations were increased, his temperature immediately became elevated 4 degrees over his previous temperature, with abdominal tenderness and rigidity. He was seen by a surgeon 24 hours later and operation advised, which was done under ethyl-chloride-ether anæsthesia. A general peritonitis was found with a perforation in the ileum 14 inches above the ileocæcal valve (size not stated). Perforation closed, gauze drainage, enteroclysis given, and patient placed in Fowler position. Patient died on the fourth day after operation, probably as a result of peritonitis. No autopsy.

CASE LXXVII.—*Perforation. Operation. Death.*

Male, white, laborer, aged twenty-eight years; hospital No. 1988; admitted September 21, 1906, on the sixteenth (?) day of disease, with an ambulatory infection and no record of Widal or leucocyte count. Temperature was 103° on admission. Had been sick for two weeks but walked around. On night before admission acute abdominal pain, tenderness, sent to the hospital with a diagnosis of acute appendicitis. Operation, ethyl-chloride-ether anæsthesia, peritonitis (general) present, perforation, 3 mm. in diameter about 8 inches from cæcum, closed, abdomen drained, bed elevated, and enteroclysis given. Died 3 days after operation. (Notes very incomplete.)

CASE LXXVIII.—*Perforation. Operation. Death.*

Female, white, housework, aged fifty-three years; hospital No. 2395; admitted October 28, 1906, on the twenty-third day of disease, with a mild infection, a positive Widal, and 5150 leucocytes. Patient had slight abdominal pain and vesical tenesmus and tenderness 3 hours before chill. Chill was severe with marked increase of pulse (96 to 132), abdominal pain, tenderness, and slight rigidity (lower right quadrant), anxious expression, said she was going to die. Not seen by a surgeon for 12 hours. Had hemorrhage 3 days before perforation and liver dulness almost obliterated. Operation about 12 hours later, large perforation, 3 mm. in diameter, 8 in. from cæcum, patient collapsed on the table. Perforation closed, abdomen irrigated, drainage instituted. Death 12 hours after operation. No autopsy.

CASE LXXIX.—*Perforation. Death. Autopsy.*

Male, white porter, aged twenty-six years; hospital No. 2415; admitted October 31, 1906, on the eleventh day of disease, with a severe infection, a positive Widal, and 8100 leucocytes. Had a persistent fever, 102° to 103°, considerable toxæmia, hemorrhages on nineteenth day (had 5 hemorrhages, totaling 44 ounces, nineteenth to twenty-first days inclusive), increasing toxæmia, and abdominal distention. No pain, tenderness, or rigidity noted day before death (twenty-second day). On twenty-first day had chill and subsequent elevation of temperature. Pulseless (day of death), cold, drop in temperature, death. Autopsy: Two perforations, one 30 cm. from ileocæcal valve and another 2 cm. from ileocæcal valve (non-adherent). Ileum at site of perforation adherent to bladder with the additional non-adherent perforation. Localized peritonitis, congestion of the lungs and kidneys, fatty degeneration of liver, swelling of lymph follicles with extensive ulceration. Perforation not diagnosed and probably not suspected.

CASE LXXX.—*Perforation. Operation. Death. Autopsy.*

Male, white, motorman, aged twenty-eight years; hospital No. 2603; admitted November 17, 1906, on the eighth day of disease, with a severe infection and no record of Widal or leucocyte count. He had moderate diarrhœa with abdominal distention from the time of his admission. On the twelfth day he developed severe sudden pain with tenderness and marked general rigidity. The breath sounds were audible over his abdomen, liver dulness was obliterated, but there was no change in his pulse or respiratory rate and no change in temperature, which had been taken hourly. His leucocytes at onset of pain were 6450, 3 hours later 3800, and 8 hours later 9000. Operation, ethyl-chloride-ether anæsthesia, general peritonitis present with one perforation, pin-head in size, in the ileum 18 inches from the ileocæcal valve. Perforation was sutured, gauze drainage, Murphy treatment instituted. Patient did well without untoward symptoms from time of operation until November twenty-sixth, when his abdomen became distended, pulse very much accelerated, restless, obliteration of liver dulness and death 12 hours later. Autopsy: General purulent peritonitis, with sloughing of enterorrhaphy and another perforation in the ileum 8 cm. above the ileocæcal valve. Bronchopneumonia, cloudy swelling of the heart, liver, and kidneys, acute splenic tumor, extensive ulceration of the ileum. Autopsy culture from lung, liver, gall-bladder, and spleen showed the bacillus typhosus, and cultures from peritoneal exudate showed the bacillus proteus.

CASE LXXXI.—*Perforation. Operation. Death. Autopsy.* Male, white, salesman, aged twenty-four years; hospital No. 2705, admitted November 27, 1906, on the twenty-first (?) day of disease, with an ambulatory infection, a positive Widal, and no record of a leucocyte count. Admitted about 24 hours after onset of sudden paroxysmal pain (recurring), liver dulness gone, marked distention, great tenderness and general rigidity. No vomiting until 20 hours after onset of pain. Peristalsis heard with difficulty, breath sounds audible over abdomen. Operation, ether anæsthesia. Perforation, small, 12 inches from cæcum, sutured, abdomen flushed, and gauze drainage. Death third day after admission. Autopsy: General peritonitis, two secondary perforations, one beside the original and another 4 cm. above the original, the original sutures having held. Cloudy swelling of heart, liver, and kidneys. Pleurisy and bronchopneumonia. Perforation occurred before admission to the hospital.

CASE LXXXII.—*Perforation. Operation. Death.*

Male, white, laborer, aged twenty-six years; hospital No. 2949, admitted December 20, 1906, on the eighteenth (?) day of disease, with a moderately severe infection, a suggestive Widal, and 3700 leucocytes. Five days later at the onset of pain leucocytes were 11,000, and six days later, 13,000. On the twenty-third day patient had sudden sharp pain, paroxysmal, recurring and abating two or three times. Later, less severe but continuous with a 1.5-degree elevation of temperature. Marked localized tenderness and rigidity in lower right quadrant which became generalized. Fifteen hours later no pain but marked tenderness and general rigidity. During one minute auscultation no peristalsis heard. Dorsal-decubitus position. Patient's pulse and respirations were increased 25 per cent. at onset of pain over the highest count on the same day previous to onset. Operation, ethyl-chloride-ether anæsthesia, which had been refused until 20 hours after onset of pain. General peritonitis found with pin-head perforation in the ileum, 8 inches above the ileocæcal valve. Perforation closed, abdomen drained with gauze, and Murphy treatment instituted. Death 4 days after operation, probably from peritonitis. No autopsy.

(*To be continued.*)

THE TREATMENT OF JOINT INFECTIONS BY LAVAGE AND DIRECT MEDICATION

By John W. Churchman, M.D.

of New Haven, Conn.

professor of surgery, yale university

(From the Yale Laboratory of Surgery)

During the past two years, in the wards of the New Haven Hospital and in the Laboratory of Surgery of Yale University, attempts have been made to apply to certain surgical infections, in particular those of the joints, some of the recent findings of chemotherapy. These studies received their stimulus from, and were based upon, observations made and published during 1912, 1913 and 1914 on the selective bactericidal action of gentian violet. The immediate significance of these early observations was in the field of bacteriology; but it soon became evident that they led into many fields and that they offered a promising clew in the field of practical therapy. It was equally evident, however, that no *immediate* transfer of the observations to the treatment of disease was possible, and that the observations were of practical value only as indicating the direction which subsequent experiments should take.

The Selective Bactericidal Action of Gentian Violet.—The first observation, on which the subsequent work rested, was that gentian violet possessed a sharp and constant selective, bactericidal property.[1] This property was at first demonstrated by staining the organism and transplanting it to the surface of agar slants. When this was done it was found that one group of organisms when stained grew as well as when unstained, while another group of organisms failed when stained to grow at all (see Figs. 1 and 2). The organisms which failed to grow when stained were referred to in the early publications as violet positive, those which grew when stained, as violet negative.* A simpler method of demonstrating this selective property of the dye and of further studying it was promptly devised. Agar plates were so poured that one-half contained plain agar while the other contained agar to which gentian violet had been added. Across these plates the organism to be tested was stroked, and the selective power of the dye manifested itself in a sensational way. Violet positive organisms refused to grow

* Or, better, gentian positive and gentian negative.

on gentian violet agar or in its neighborhood; violet negative organisms grew equally well on the two sides of the plate (see Figs. 3, 4 and 5). This reaction was sharp and constant and its sensitiveness is indicated by the fact that the gentian violet in the plates from which Fig. 3 and Fig. 4 were made was only in the strength of one to one hundred thousand, while similar results were obtained in many of the experiments with much weaker solutions.

Parallelism of Gentian Reaction and Gram Reaction.—By this method of inoculation on divided plates the original study of the commoner organisms was extended to include three hundred and thirty-four strains representing one hundred and thirty-eight distinct bacterial species. The results showed, as the original observations had suggested, that bacteria can be pretty sharply divided into two groups according as their growth is or is not inhibited by gentian violet. The additional interesting fact was brought to light that the gentian violet reaction runs roughly parallel to the Gram reaction. It was found that the large majority of Gram positive organisms are also gentian positive, and the large majority of Gram negative organisms, gentian negative. The actual figures are as follows:

		Violet positive	Violet negative
130 species	Gram positive, 77....	70 (90 + per cent.)	7 (9 + per cent.)
	Gram negative, 53....	8 (15 + per cent.)	45 (84.9 + per cent.)
		Violet positive	**Violet negative**
318 strains	Gram positive, 182....	165 (90 per cent.)	17 (9.3 per cent.)
	Gram negative, 136....	15 (11 per cent.)	121 (88.9 per cent.)

To this parallelism there were, as the table indicates, a number of exceptions, and later observations of Winslow showed that a study of the Gram negative cocci would probably increase the number of exceptions. However, making allowance for these facts and for the notorious uncertainty of the Gram stain, the parallelism between the two reactions remains sufficiently striking.

Isolation of Pure Cultures by the Method of Divided Plates.—It was next shown that, by the method of inoculation on divided plates, isolation of gentian negative organisms in pure culture out of mixtures with gentian positive organisms could be readily accomplished. Such an isolation of B. typhosus in pure culture out of a mixture with B. subtilis and M. aureus is illustrated in Fig. 6; and Petroff working in Trudeau's laboratory has recently been able, by the use of gentian violet in a modification of the method here described, to isolate B. tuberculosis in pure culture from the stools. This is the first time that such isolation has been successfully accomplished.

Many of the organisms which float in the air belong in the Gram positive—and hence in the gentian positive group—and it is a matter of a good deal of importance to bacteriology that these organisms which cause so much trouble, as air contaminators, fail to grow in the presence of the dye. That they do so fail to grow is shown in Fig. 7.

That some of the aniline dyes are capable of injuring certain animal cells has long been known. In 1890 Stilling published a Strassburg thesis [2] on the antiseptic action of aniline dyes with particular reference to pyoktanin (probably a mixture of several dyes); but he failed to observe any selective action of the dyes, and made wholly unwarranted claims for its bactericidal property, which led to unwise clinical use and subsequent disrepute. The important lead obtained in 1902 by Drigalski and Conradi [3] as to the selective bactericidal action of crystal violet was not, owing to the chief interest of these authors in the cultivation of B. typhosus, followed up by a systematic study of the dye. The observations reported in my early publications, therefore, while not entirely without precedent, call attention to a number of points not previously observed. These points may be summarized as follows:

1. The reaction of an organism to gentian violet, when planted on a divided plate, is a characteristic as easy to determine, as constant, as clear cut, and as significant as any known mark by which bacteria are identified. The Gram stain is not to be compared with it as regards definiteness or constancy. It fails to be of value in the case of the small number of organisms (*e.g.*, pneumococcus, *Diplococcus gonorrhœa*) which will not grow well on plain agar, or whose slight growth is inhibited by almost any change in the media. For a small group of organisms the reaction is not absolutely constant and therefore, in their case, not altogether satisfactory.

2. The isolation of gentian negative organisms from mixtures with those which are gentian positive is readily accomplished by transplantation on divided plates.

3. In the same way, cultures of gentian negative organisms may readily be freed of air contaminations.

4. The transplantation on divided plates may be of assistance in demonstrating the presence of a contamination in a supposedly pure culture.

Action of Gentian Violet on Closely Related Bacterial Strains.—It was not expected from these early studies that closely related organisms would differ in their behavior toward gentian violet; and it was found, by a study of the effect of the dye on one hundred and thirty-eight distinct bacterial species, that nearly allied organisms were, in general,

similarly affected by the stain. In a study, however, of five nearly identical strains, belonging to the enteritidis group, the selective affinity of the stain was found to be so specific in character as to distinguish between different strains of very closely related organisms.[4] Though these five organisms were identical in their reaction to all the ordinary bacteriological tests, gentian violet constantly inhibited one member of the group while on the growth of the other four it was absolutely without effect (see Fig. 8). This observation was not only of significance for bacteriology, but also showed how cautious one must be in generalizing as to the effect of a chemical on closely related organisms, and illustrated in a quite simple way the well-known phenomenon of "fastness."

Toxicity of Gentian Violet and Its Fate in the Animal Body.—These observations of bactericidal properties possessed by gentian violet, and particularly of the affinity of this dye for pyogenic organisms, made it important to determine its toxicity and its fate in the animal body.[5] This was done by intravenous injections of the dye into rabbits, very strong solutions and large doses being used. Though a few of the experimental animals died in convulsions immediately after the injections, most of the animals were found to tolerate enormous doses of the dye in the circulation and to remain perfectly well. Prompt and fairly deep staining of the mucous membranes took place, but the most important fact brought out by this study was the rapidity with which the animal changed the dye into some substance not possessing the selective bactericidal property. This was demonstrated by injecting gentian violet intravenously and then making divided plates with blood withdrawn from the ear at varying intervals. In the plate made immediately (see Fig. 9) the usual selective action of the dye manifested itself, and this was also true of the plate made after three-quarters of an hour (see Fig. 10), though here the reaction was not quite so sharp. At one and three-quarter hours, however, the blood had entirely lost its selective bactericidal property (see Fig. 11). The importance of this observation in any attempts to apply aniline dyes to the treatment of infection by injection into the circulation, is too obvious to need more than mention.

Effect of Staining with Gentian Violet on the Bacteria.—The changes wrought in the injected dye by the animal organism led also to studies of the changes produced in the bacteria.[6] The purpose of these studies was to determine particularly whether gentian positive organisms when deeply stained might, by throwing off the stain or in some way changing it, survive if placed in the most favorable environment

FIG. 1.—The tube on the left was inoculated with B. prodigiosus for control; that on the right with B. prodigiosus which had been stained for one hour with gentian violet. Note that the growth of the stained organisms was unaffected by the dye. Compare with Fig. 2.

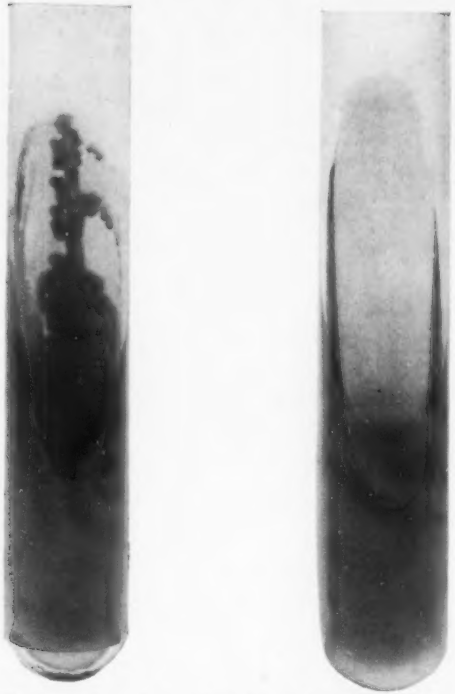

FIG. 2.—The tube on the left was inoculated with blastomyces for control; that on the right with blastomyces which had been stained for one hour with gentian violet. Note that the growth of the stained organisms was completely inhibited by the dye. Compare with Fig. 1.

FIG. 3.—The plate has been stroked with an emulsion of sarcina rosea. The growth refuses to approach the dividing line. Note the mark of the inoculating needle in the gentian violet agar, which contains the dye in a strength of 1–100,000. Notice the diffusion of the stain into the plain agar across the dead line. Compare with Fig. 4.

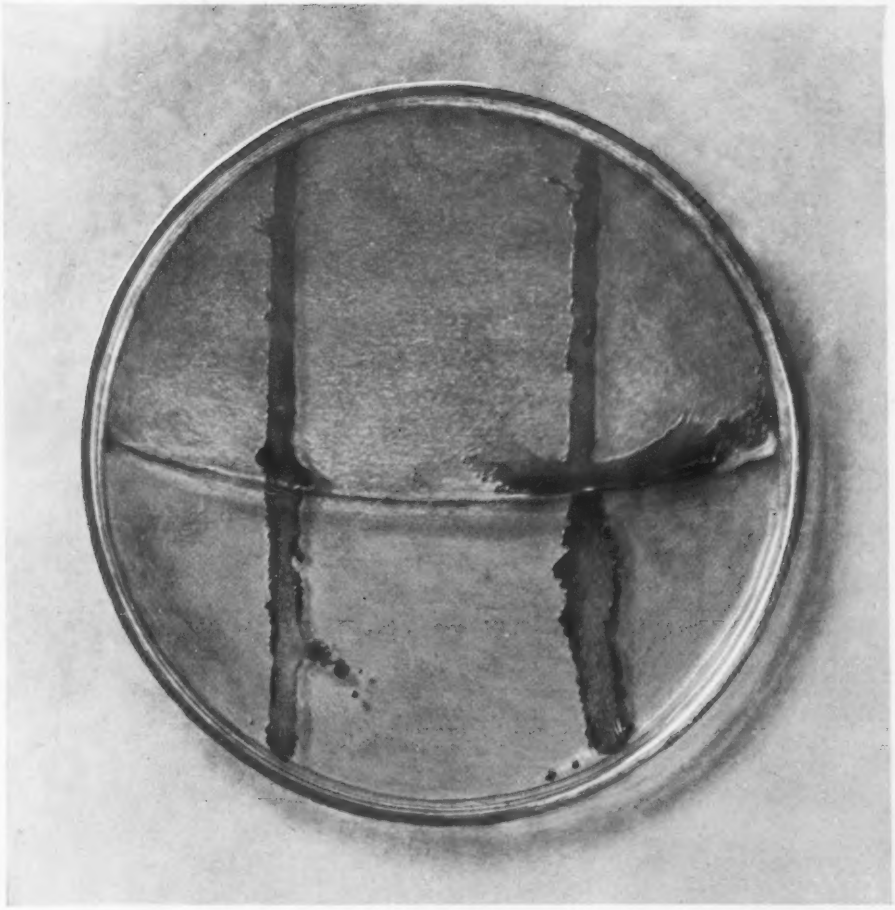

FIG. 4.—The plate has been stroked with an emulsion of B. prodigiosus. Growth has been uninfluenced by the dye. Note the staining of the growth on the gentian violet half of the plate. Compare with Fig. 3.

FIG. 5.—Two stroke cultures of B. prodigiosus have been made on this plate, separated by a stroke culture of B. subtilis, the selective action of the gentian violet (in the upper half of the plate) being thus clearly demonstrated. B. subtilis refuses even to approach the dividing line, while B. prodigiosus grows equally well on the two sides.

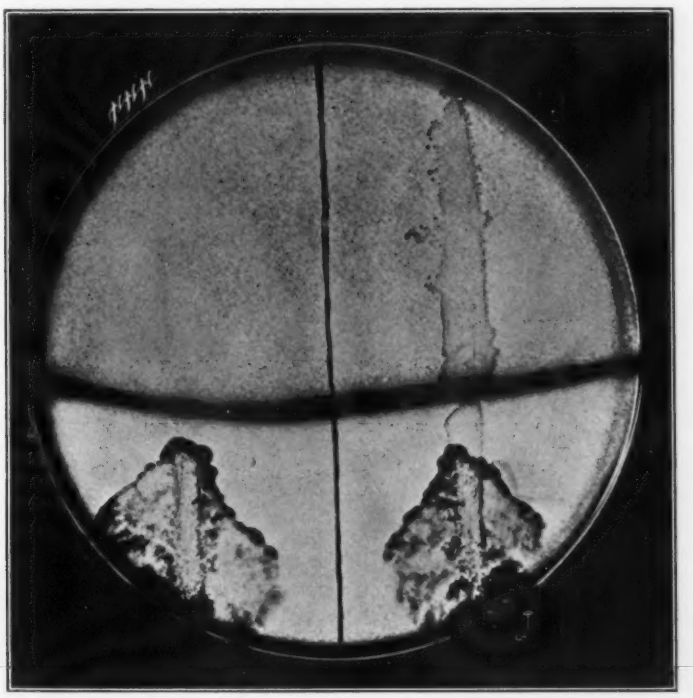

FIG. 6.—The left half of the plate has been stroked with a mixture of B. subtilis and M. aureus. The luxuriant growth in the plain agar ceases sharply some distance from the dividing line and the edge of the growth is seen to be stained by the dye which is diffused across the line. On the gentian violet agar there has been no growth whatever. The right half of the plate has been stroked with the same mixture plus B. typhosus; and at the point where the growth of B. subtilis and M. aureus ceases a pure culture of B. typhosus is seen to start, crossing the line and growing well on the gentian violet agar.

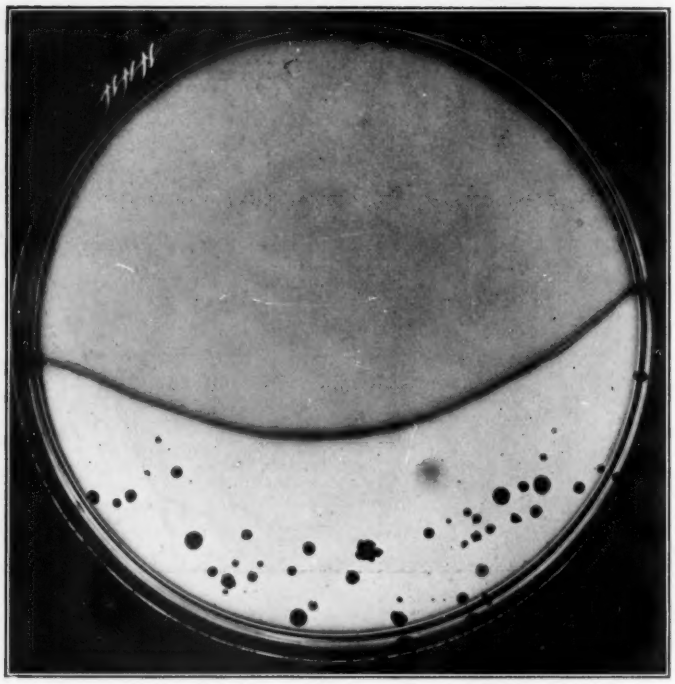

FIG. 7.—This plate was exposed before an open window for one hour on a rainy day. All the air contaminations have grown on the plain agar half; none on the gentian violet half.

FIG. 8.—The plate has been stroked with 5 strains of B. enteritidis identical in their behavior to all the bacteriological tests. It will be seen that one strain refuses to grow in the presence of gentian violet, while the growth of the other four is uninfluenced by the dye.

FIG. 9.—Divided plate made with blood withdrawn from the heart of an animal which had received 10 c.c. of a 1 to 200 solution of gentian violet intravenously. Blood withdrawn and plate made immediately after injection of the dye. Organisms used were B. coli, B. subtilis, M. aureus, and B. typhosus. Selective bactericidal property of the dye present.

FIG. 10.—The same as Fig. 9, except that blood was withdrawn and plate made three-quarters of an hour after injection of the dye. Selective bactericidal property of the dye still present.

FIG. 11.—The same as Fig. 9 except that blood was withdrawn and plate made one and three-quarters hours after injection of the dye. Selective bactericidal property of the dye has disappeared.

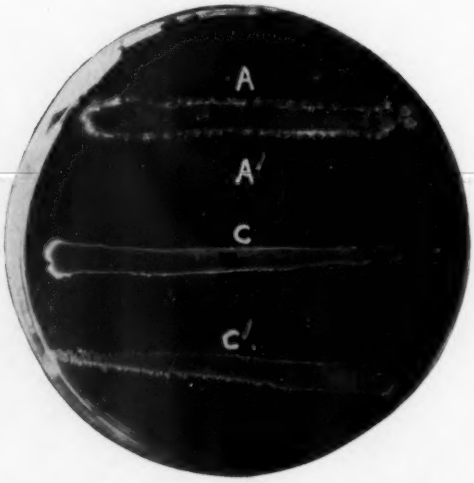

FIG. 12.—Showing that methyl violet possesses a selective bactericidal property like that of gentian violet. The plate is a plain agar one. It has been stroked (*A* and *C*) with unstained B. anthracis and B. coli for control; and also (*A'* and *C'*) with stained B. anthracis and B. coli. The former has been killed, the latter is unaffected by the dye.

FIG. 13.—Showing that crystal violet possesses a selective bactericidal property like that of gentian violet. The upper half of the plate contains crystal violet agar. It has been stroked with B. coli, B. anthracis, staphylococcus, and B. typhosus. The growth of two has been stopped, of the other two, unaffected.

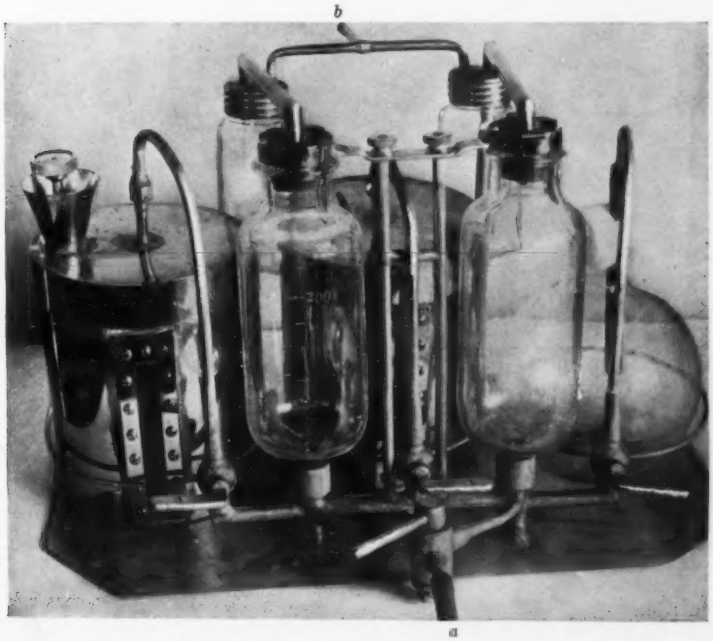

FIG. 14.—Apparatus for irrigating joints and applying antiseptics. All stopcocks are readily removable for purposes of cleaning, as are also the covers of all bottles and reservoirs.

within the animal body. It had already been shown that the gentian positive organisms when changed could not survive *in the environment of ordinary bacteriological media.* The first experiments in this direction were done with M. aureus. Emulsions of this organism were deeply stained and large doses injected into the ear veins of rabbits. The animals were in no way affected by the injection, though controls which received unstained organisms died promptly of staphylococcus septicæmia. Similar results were obtained with a species of blastomyces, especially suitable for experiments with guinea-pigs. With B. anthracis quite remarkable results were obtained. For the injections with this organism a highly susceptible animal (the mouse) was used and large doses of the organism employed. The controls died within forty-eight hours, with the usual findings in the heart's blood and spleen. But the animals receiving stained organisms, though not eventually surviving, remained perfectly well for periods varying from ten to twenty-five days, at the end of which time they died of anthrax septicæmia. Where the organisms which finally killed the animal were in the long interval of good health between injection and death, and why they did not cause death sooner, if they were to cause it at all, are highly important questions which further experimental study has as yet failed to answer satisfactorily.

It is interesting to note that Madame Henri has recently reported to the French Academy of Sciences similar results of experiments with B. anthracis. In these experiments guinea-pigs injected with the organism, which had previously been exposed to ultra-violet rays, survived for a long time but finally died of the disease, though in an atypical form. These results Madame Henri has rather hazardously interpreted as indicating a true mutation of bacteriological species under the influence of ultra-violet rays.

The Selective Bactericidal Action of Stains Closely Allied to Gentian Violet.—An attempt made to determine which part of the gentian violet molecule was responsible for its sensitive selective affinity for bacteria led to a study of a number of other stains closely related to gentian violet in chemical structure.[7] Dahlia, parafuchsin, magenta, pararosanilin, rosanilin, crystal violet and methyl violet 5B. were the dyes used; and they were found to possess the same selective bactericidal property as that exhibited by gentian violet (see Figs. 12 and 13).

Effect of Gentian Violet on Enzymes, Toxins and Ultra-Microscopic Infections.—Experiments were next undertaken to determine the effect of the dye on enzymes, toxins and ultra-microscopic infections.[8] The original purpose of these experiments was to provide a new method of

studying ultra-microscopic infections, and to see if it might not be possible, by adding a dye to an infectious agent, to stain and thus to kill organisms too small to be seen. It was first, of course, necessary to show that toxins themselves were uninfluenced by the dye. An organized ferment (yeast) was first studied and its power to ferment sugar found to be lost after the yeast cells had been stained. Five organized ferments (pytalin, pepsin, trypsin, rennin and thrombin) were also studied in this way and their activity found to be unaffected by staining with the gentian violet. Staining of the diphtheria toxin also was found to impair in no way its toxicity. Of the ultra-microscopic infections, two were studied, vaccinia and infectious material from anterior poliomyelitis. The first of these was entirely unaffected by staining; with the second the results were inconstant.

Effect of Gentian Violet on Protozoa and Growing Animal Tissue.—The study was also extended to include observations of the effect of the dye on protozoa and on growing animal tissue.[9] The purpose of these experiments was to determine (*a*) whether the nucleus of a cell could be stained during life and (*b*) whether such a stained cell is capable of further reproduction. The commonly accepted notion is that nuclear stain is a certain sign of death, but both of the questions put were answered by our experiments in the affirmative. We were able, that is to say, to demonstrate that the nucleus could be stained by gentian violet during life; and succeeded, not only in growing animal tissue in media containing the dye, but also in observing the subdivision of cells whose nuclei were stained, as well as the subdivision of the stained nuclei themselves. These observations, which are recorded in Figs. 14 and 15, demonstrate the fact that a highly diffusible dye like gentian violet, in contact with living cells, enters the nucleus during life and, though staining it, does not prevent its further growth. The importance of this fact, so far as the therapeutic use of stains is concerned, is obvious. It may also lead to a useful modification of the technic of cultivating tissue—by diminishing the risk of bacterial infection—to a facilitation of the study of nuclear growth, and possibly to providing a means for the isolation in pure culture of tissue from a mixture, through the selective action of dyes.

Application to the Treatment of Infections.—These were the experimental studies which stimulated me to undertake clinical experiments, having for their purpose the application of the bactericidal activity of certain aniline dyes to some of the unsolved problems in the surgical treatment of infections. The only possible excuse for attempting to use gentian violet in this way, rather than one of the many well-known

and efficient bactericides at hand, lies in the extreme diffusibility of the dyes, their relative harmlessness, and the fact that the presence of very weak solutions of the dye in media prevents the growth of a number of the commoner organisms of suppuration. It should be said at once that gentian violet is not absolutely non-poisonous nor absolutely non-irritant; and a careful study would probably prove the same statement true of other dyes, for which loose claims as to their harmlessness have been circulated. It is also evident that it would be absurd to expect any effect on organisms floating in the blood stream from gentian violet injected into the circulation. The experiments already referred to prove conclusively that the bactericidal property of gentian violet circulating in the blood stream soon disappears. Stilling, in his publications on pyoktanin, failed to investigate this point, and his failure was responsible for his extravagant claims for the dye. The point has also doubtless been equally overlooked by others in making statements about other dyes.

Both the irritant quality and the poisonous quality of gentian violet are, however, moderate; and this point having been determined by experiments on animals and human beings, it seemed advisable to begin attempts to use this highly diffusible bactericide on surgical infections, which owe their chronicity to the persistence of the organisms in the depths of tissue, where they cannot be reached by ordinary antiseptic agents. Infections of the joints and infections of the mucous membranes suggested themselves as the most promising fields of attack, and it is the early studies in the treatment of joint infections by this method which I wish to report here.

It is obvious that it would be absurd to expect, as Stilling did in his work with pyoktanin, that the simple introduction of a diffusible dye into an inflammatory area (for example, into an abscess) would be of any avail; for the dye in this case would either not come into contact at all, or only in a partial and casual way, with the frontier of the infection (for example, the abscess wall), where the hidden organisms responsible for the persistence of the infection are lodged. The difficulty of getting the dye into actual contact with the mucous membranes was shown by attempts made to treat a diphtheria carrier by painting the pharynx and tonsils with gentian violet. The diphtheria bacillus is constantly gentian positive, and I had shown by experiments on the joints, tongue and bladder that the living mucous membrane could be stained down to the underlying tissue by application of the dye to the surface. To attempt to reach

the organism in the depths of the mucous membrane by painting the pharynx and tonsils seemed, therefore, a rational procedure.

The results were somewhat suggestive, but an unexpected obstacle was met in the secretion of the mucous glands of the pharynx. This material lay over the surface of the pharynx in a thin slimy layer, which was renewed by fresh secretion as rapidly as it was removed, and which prevented intimate contact between dye and mucous membrane as effectually as a layer of grease would have done. The observation was instructive as indicating some of the difficulties which will have to be overcome in attempting to treat infections of mucous membranes by local applications.

It seemed certain that in the case of suppurating joints a difficulty of a similar nature, and much more marked in degree, would be encountered, and that it would be foolish to expect a dye injected into a joint cavity filled with pus and fibrin to reach the depths of a mucous membrane which is covered with the same material intimately attached to it.

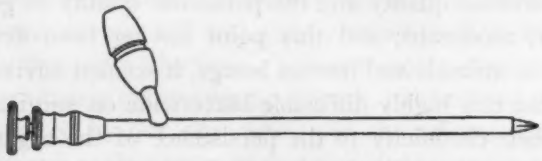

FIG. 15.—Aspirating needle used (actual size, bore of needle—inside measurement—4 mm.).

Before applying the dye to the surface of the joint it was, therefore, necessary to devise some method of efficient preliminary cleansing of that surface. For this purpose the apparatus illustrated in Fig. 16 was devised. It consists essentially of a number of chambers, connecting with each other by means of tubes controlled by stopcocks, and the whole system leading on the one hand to a single tube to be connected with the needle inserted into the joint (*a*), and on the other, to a reversible, rotary electric pump (*b*). This apparatus, with the aspirating needle (see Fig. 15) attached, can be autoclaved ready for use, the bottles containing any fluids desired for irrigation or therapeutic purposes. After the aspirating needle has been inserted into the joint, the whole system is a closed one with no possible risk of contamination. The joint may then be irrigated as long as desired without exposing any of the interior of the apparatus; so that the usual dangers to a joint, of contamination from without, present in any method of aspiration and irrigation dependent on syringes or gravity, are avoided. The aspiration and irrigation may be readily done under local anæsthesia and may, therefore, be repeatedly done.

A description of the technic developed (the clinical studies thus far have been concerned only with the knee-joint) will best illustrate how the apparatus is used. About 150 c.c. of 2 per cent. novocaine are placed in bottle A (Fig. 16), reservoir C is filled with salt solution, reservoir D with gentian violet, and the apparatus is autoclaved and allowed to cool. A large calibre aspirating needle (see Fig. 15) is attached to the rubber tube at F and a rubber tube leading from G attached to the outlet of a reversible, rotary electric pump. H and I are air traps to prevent the suction of fluid from A and B back into the

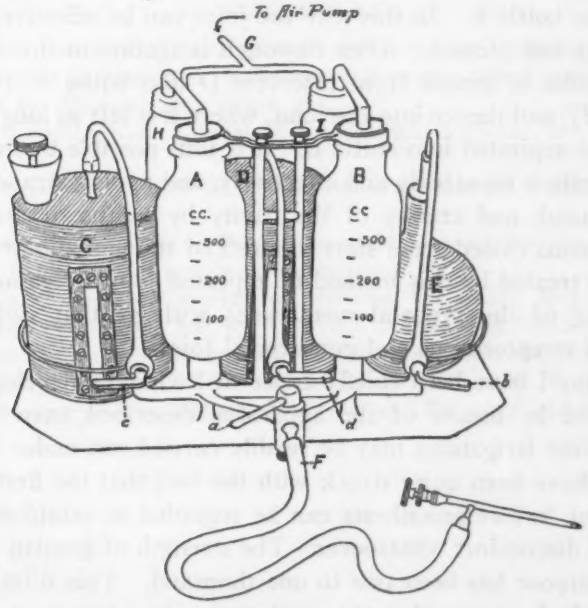

FIG. 16.—Diagram of irrigating apparatus, made from photograph. The air pump used is a reversible rotary electric pump giving a maximum pressure of 130 mm. of mercury and a maximum vacuum of 160 mm.

pump. It will be apparent that by opening the proper stopcocks and using either suction or force in the pump, it is now possible to apply this suction or force to the joint or to any one of the bottles in the system, and thus either to distend or to empty the joint as well as to fill or to empty the bottles at will. For example, after the usual skin preparation of the knee and careful isolation of the field with towels, a small area of skin and subcutaneous tissue is infiltrated with 2 per cent. novocaine. The aspirating needle is then inserted into the joint, the skin being dislocated over the subcutaneous tissue in the usual way to prevent subsequent fistula formation. The obturator is now pulled out

of the needle, suction started in the pump, and the cock *a* opened. Any fluid in the joint is thus aspirated into bottle B. By closing *a*, opening *b*, and applying force in the pump, this fluid is then forced into bottle E to be preserved for examination. Stopcock *b* is now closed, stopcock *a* reversed, and force started in the pump. Novocaine is thus forced out of bottle A into the joint, which it distends. The novocaine is left in the joint for five minutes and then aspirated into bottle B until the joint is quite empty. Salt solution is then drawn from reservoir C into bottle A, forced from bottle A into the joint and withdrawn from the joint into bottle B, from which any excess can always be easily forced into bottle E. In this way the joint can be effectively irrigated as often as one pleases. After thorough irrigation in this fashion the gentian violet is forced from reservoir D into bottle A (by opening stopcock *d*), and thence into the joint, where it is left as long as desired, to be again aspirated into bottle B. It is thus possible to anæsthetize a joint, irrigate it repeatedly and effectively, and apply therapeutic agents to every nook and cranny of the cavity by means of an apparatus which remains closed from start to finish of the operation.*

I have treated by this method of repeated joint irrigation followed by staining of the synovial membranes with gentian violet a small number of streptococcus and gonorrhœal joints.

Thus far I have been chiefly concerned with the development of a technic, and by means of the apparatus described have found that repeated joint irrigations may be readily carried out under local anæsthesia. I have been quite struck with the fact that the first distention of the joint, before anæsthesia can be regarded as established, causes no pain or discomfort whatsoever. The strength of gentian violet used for this purpose has been one to one thousand. This dilution was of course worked up to with great caution, the experiments in the human being being constantly preceded by experiments in animals to indicate what dilutions could safely be used. It was found that gentian violet in this strength caused no pain or signs of subsequent irritation. In some cases the dye was used in a strength of one to five hundred.

As to the results of this method of treatment of joint infections with gentian violet, it is at this time too early to speak positively. The purpose of this paper is to describe an effective method of joint lavage. This had to be developed before attempts to apply the bactericidal prop-

* Since this article was written the apparatus here described has been modified so as to make it above criticism from a bacteriological stand-point. No air reaches the interior of any part of the new apparatus except through a bacteria-proof filter. This will be described in a subsequent publication.

erties of gentian violet, first observed two years ago, to infectious processes in the joints, could be logically undertaken. And the method I have outlined has gone a great way toward the solution of the preliminary problem. The number of cases treated is small, but some of them have put the method of lavage and staining to a rather severe test. It can be said at least that the results have been sufficiently encouraging to justify a continuance of the study, which is now being carried on in the laboratory of surgery at Yale University and in the wards of the New Haven Hospital.

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ACUTE GANGRENE OF THE GALL-BLADDER FOLLOWING INJURY

By J. Louis Ransohoff, M.D.
of Cincinnati, Ohio

Acute gangrenous inflammation of the gall-bladder associated with stone is not an uncommon condition. It is only in the absence of stone that these cases assume unusual interest. One or more of three underlying conditions are essential to gangrene of the gall-bladder; one, distention, two, interference with circulation, and, three, infection. The presence of a large stone in the cystic duct may in itself act in these three ways.

As Czerny[1] has pointed out, a large stone locked in the cystic duct may cause not only distention, but by direct pressure on the cystic artery may sufficiently interfere with circulation to cause gangrene.

Friedrich[2] asserts that the majority of cases of gall-bladder gangrene are associated with solitary stone either locked in the cystic duct or in a contracted gall-bladder. The pressure of the stone causes a decubitus ulcer which is frequently the site of a gangrenous perforation. Here the gall-stone plays the same rôle as a fecal stone in the far more frequent gangrenous appendicitis.

According to Aschoff, a gall-bladder which has been the seat of infection is at all times liable to be the site of severe recurrent inflammation. In apparently healed gall-bladders he has demonstrated streptococci dormant in the deeper layers of the mucosa. These germs may be lighted to renewed activity by slight trauma. These cases are analogous to the severe appendix inflammations, which so often occur after repeated mild attacks.

The explanation of acute gangrene of the gall-bladder unassociated with stone is always difficult. Kocher[3] reports a case of acute gangrene of the gall-bladder occurring on the eighth day of an otherwise uneventful course and following an operation for ventral hernia. The patient suddenly experienced a violent attack of pain in the right hypochondrium with chills and high fever. Operation revealed a gangrenous gall-bladder distended to the size of a small pear.

One of the most interesting cases of gangrene of the gall-bladder, without stone, is reported by Korte[4]:

A woman, twenty-one years old, three months pregnant, became suddenly ill, with intense pain in the epigastrium, followed by chills and fever, and the development of exquisite tenderness in the right hypochondrium. Operation on

the twelfth day of the illness revealed a perforating gangrene of the gall-bladder, without stones. Korte says of this case, that it must be supposed that following an acute infection, the opening of the cystic duct became occluded. This, of course, was followed by a distention, infection and gangrene.

Brunning's[5] case is in many ways similar to Korte's. While riding on an electric car a man sixty-eight years old experienced a violent pain in the hypochondrium, associated with collapse. This was followed by a continued prostration, chills and fever. Operation on the eighth day revealed a complete gangrenous gall-bladder with hemorrhagic infiltration of the mucosa.

This case Brunning also attributes to an acute virulent infection with inflammatory closure of the cystic duct.

Ransohoff's[6] case is in a way similar to Kocher's. A previously healthy male, aged twenty-one, after unusual indulgence in beer, had a violent attack of vomiting. This was almost immediately followed by excruciating pain in the epigastrium and lower abdomen and septic prostration. The diagnosis was made of acute gangrenous appendicitis, but the operation revealed a gangrene of the gall-bladder.

The S-shaped course of the cystic duct seems to have a peculiar effect on these cases. As the distention of the gall-bladder increases, the angulation of the S-shaped curve of the cystic duct becomes more acute, making the obstruction more complete. The more complete the distention, the more complete the obstruction, and *vice versa*.

In many of these cases it seems not unlikely, particularly in the cases of Ransohoff and Kocher, that the obstruction was primary, and the infection secondary. In both cases it is not improbable that the vomiting may have caused an angulation of the cystic duct with complete obstruction, followed by acute over-distention of the gall-bladder. infection and gangrene from interference with the circulation. The intimate relation of the cystic artery with the cystic duct presupposes that an acute angulation of the duct might be accompanied by obstruction of the artery. An analogy of this type of gangrene is occasionally seen in an otherwise normal ovary with twisted pedicle.

CASE.—M. L., male, aged forty-five, Portsmouth, Ohio. Six years ago a gall-bladder operation was performed by Dr. J. B. Deaver, of Philadelphia. As the history of this operation was not available, it was not known whether a cholecystectomy or a cholecystostomy had been done. Two weeks before the onset of the present illness the patient had fallen from a step-ladder, receiving a severe blow in the region of the " floating rib " on the right side. The soreness disappeared after several days. May 1, without previous warning, he had an attack of excruciating pain over the gall-bladder region, accompanied by vomiting and prostration. This was followed by fever ranging from 101° to 104°,

with rapid pulse and chills. May 4, I saw the case with Dr. S. S. Halderman, at Portsmouth. The patient presents every appearance of being seriously ill.

The facial expression is that of peritonitis, and the body is covered with cold perspiration. Although there is no jaundice, the patient has that subicteric hue, so characteristic of severe infections about the liver. Temperature 101°, pulse 130, leucocyte count, 18,000. There is exquisite tenderness over the gall-bladder region, the most superficial pressure eliciting excruciating pain.

There is a scar, evidently of an old gall-bladder incision, over the hypochondrium. Considering the history, the exquisite pain and tenderness, and the evident serious sepsis, the diagnosis of acute gangrene of the gall-bladder was made.

Under ether anæsthesia, an incision was made through the middle of right rectus, and the gall-bladder was found buried in adhesions. It was distended to the size of a pear, completely gangrenous, but not ruptured. The gall-bladder was opened, and a large quantity of black bile and pus, mixed with shreds of gangrenous mucosa, was evacuated. Almost the entire mucous coat of the gall-bladder came out in pieces. As the condition of the patient was far too grave to consider cholecystectomy the operation was completed by inserting a drain in the gall-bladder, and protecting the entire region by packing. The recovery was slow but uncomplicated. The fistula closed in about eight weeks. Since then the patient has been free from all symptoms.

It is an interesting fact that in many of these very severe infections of the gall-bladder the pre-operative diagnosis of acute gangrenous appendicitis is made. In this case, of course, the diagnosis was simplified by the previous history. The diagnosis is particularly difficult in those cases which give absolutely no history of previous gall-bladder trouble, but come on without warning of any kind. It is noteworthy that in the presence of severe intra-abdominal infections the entire abdominal wall is often so rigid as to preclude an exact localization of the lesion. This is occasionally seen in acute perforation of a duodenal or gastric ulcer, without previous symptoms. However, it is unwise in any of these cases to wait for localizing symptoms to develop. Desirable as exact diagnosis is, under all conditions, it is nevertheless advisable to operate in these cases even in the absence of exact diagnosis, as any delay is apt to take away the patient's only possible chance of recovery. The evidence of intra-abdominal disaster is sufficient indication for operation.

The cause of the gangrene of the gall-bladder in the case cited

above is not easy to ascertain. The trauma experienced two weeks before was in all probability a causative factor. This may have acted by liberating bacteria dormant in the deeper layers of the mucosa. Another possibility is that of a twist of the adherent gall-bladder, with subsequent distention and infection.

The grave condition of these cases as a rule prevents cholecystectomy. Fortunately it is unnecessary, as the gall-bladder mucosa usually sloughs out, often as a whole, during convalescence.

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SITUS VISCERUM INVERSUS WITH GALL-STONES

By Harry W. Horn, M.D.
of Wichita, Kansas

The very interesting condition of situs viscerum transversus is rare, and the occurrence of gall-stones when this condition is present is evidently of much greater rarity, judging from the literature. The symptom complex may be extremely perplexing and, unless a complete physical examination is made, the possibility of the occurrence of a left-sided cholelithiasis may be lost sight of.

The occurrence of pain in the left hypochondrium, with tenderness underneath the left costal arch, or epigastric pain with radiation to the left hypochondrium, accompanied by left hypochondriac tenderness may be cleared up by a careful examination of the chest. The cases reported have all shown a coexisting cardiac transposition, and, in those cases in which a diagnosis was made before operation, the finding of the dextroposition of the heart was the key-note to the solution of the diagnosis. The X-ray will verify the condition. The cases have usually gone for a number of years without diagnosis.

Bland Sutton, in speaking of abnormalities of the gall-bladder, says the chief of these are connected with complete transposition of viscera. In this connection, the liver lies mainly in the left hypochondrium and the actual condition of its lobes is reversed, the left lobe being larger than the right and lodges the gall-bladder; the duodenum and the stomach are also reversed.

The case which I shall report was referred to me by Dr. J. Z. Hoffman.

> The patient, a housewife of fifty-one years of age, presented herself for relief from pain in the left hypochondrium. One year ago she sustained a jarring injury to the left hypochondriac region and since that time the pain has been worse. The pain has existed over a period of thirty years. It is constant and of a severe, aching type, with occasional acute sharp pain. It begins just underneath the left costal arch and radiates upward toward the left shoulder blade and downward over the left half of the abdomen. Often it is cramp-like and has been so severe at times as to demand morphine for relief. Nausea frequently accompanies the pain and a

few times she has vomited. Jaundice has never occurred, and the patient has never observed clay-colored stools. This pain does not bear any relation to the digestive process.

Epigastric distress in the form of a sensation of weight and "heartburn" is of frequent occurrence after meals, with belching of gas. This usually occurs immediately after eating. Bowels are constipated.

Dyspnœa is marked on slight exertion and is associated with severe palpitation. There has been no loss of weight.

Past History.—There is no history of typhoid. She has had repeated attacks of tonsillitis, with some rheumatism.

Sexual History.—Menopause occurred four years ago. She has had four full-term pregnancies with no complications. One pregnancy terminated at seven months.

The family history is negative.

Physical examination reveals a woman of small stature and a poorly-developed musculature. There is no jaundice. Palpation over the left hypochondrium reveals pronounced tenderness, aggravated on hooking the fingers under the costal arch on deep inspiration. The epigastrium reveals slight tenderness. The lower margin of the liver can be felt two fingers below the costal arch, on deep inspiration. Examination of the chest reveals the absence on the left side of the cardiac dulness and apex beat. The cardiac dulness begins at the left border of the sternum and extends to the right mamillary line. Heart sounds were heard best on the right. Liver dulness was found on the left side. There is a systolic murmur at the apex. The lower extremities presented slight œdema. (X-ray examination of the chest and abdomen corroborated the diagnosis of transposition of the viscera.)

Blood: hæmoglobin 80; red blood-cells 4,200,000; white blood-cells 10,600. Stools, negative. Urine, acid; specific gravity, 1020; trace of albumen; no sugar, a few hyaline casts. Systolic blood-pressure, 130.

Operation.—Ether anæsthesia. Assistants, Drs. J. Z. Hoffman and Edgerton. A left rectus incision was made. The gall-bladder was readily accessible. Its walls were thickened but free from adhesions. About 70 c.c. of greenish-black bile was aspirated, and the gall-bladder was incised and four mulberry stones, the size of a pea, were removed. The ducts were free. The bladder was drained. The anomaly of transposition of the viscera was verified. The patient did not bear the anæsthesia well and a hasty closure was made. An uneventful recovery followed.

One year later the patient reported complete recovery from

the left hypochondriac distress, but she still complains of epigastric distress.

A fairly exhaustive review of the literature reveals the rarity of this condition.

CARL BECK reports one case, in which the patient was a woman thirty-nine years of age, who complained of severe headaches followed by vomiting and sometimes chills; pain of a colicky character in the left lumbar region. The attending physician diagnosed transposition of the viscera. When she complained of lumbar pain he found a movable kidney on the left side, and advised nephropexy. This was done and 9 days later the same gastric symptoms recurred. An exploratory incision was then made and cholelithiasis was found, with the liver lying in the left hypochondrium. The patient made a good recovery.

FRANK BILLINGS reports a male aged sixty-four and married. His illness began in 1895. There was history of severe epigastric pain which radiated over the entire abdomen. Great depression without nausea and vomiting. A chill followed by fever occurred and the next day there was slight jaundice. Two more attacks occurred within the next two weeks. In 1896 he visited Carlsbad and other European resorts. Gradually he lost weight. Physical examination revealed the cardiac dulness, beginning at the left sternal border and extending across the sternum to the right nipple line. Heart sounds were heard loudest to the right of the sternum. A hard, tumor-like mass was felt at the costal margin at the tenth left cartilage. Liver dulness was found on the left side and the stomach, distended with gas, occupied the right hypochondriac and epigastric regions. Situs viscerum inversus was recognized and a diagnosis of cholelithiasis was made.

DR. CHRISTIAN FENGER operated and found a large stone in the cystic duct. The ducts were all dilated. The anomaly of transposition was verified. The patient died on the fourth day from septic angiocholitis. No autopsy.

H. KEHR, LIEBOLD and NEULING report 312 laparotomies for gall-stones, from 1904–1906. Among these cases there was one of complete transposition of the viscera. The patient was fifty-five years of age, and a diagnosis of situs viscerum inversus was made and confirmed by X-ray. The stone was in the common duct. The patient made an uneventful recovery.

WM. J. and CHAS. H. MAYO mention the cases reported by Billings and Carl Beck and "one case in our experience." No reference is given to literature containing the report of their (Mayo's) case and the history is not given.

HUPP reports a case of a woman 4½ months pregnant and suffering from cholelithiasis. She was deeply jaundiced and had been steadily losing weight. Operation was decided upon. Transposition of the viscera was not suspected. A right-sided incision was made and the gall-bladder was not found in the usual location. Further exploration revealed the liver completely transposed to the left side. Two large stones were removed from the cystic duct and the patient made an uneventful recovery and was delivered at full term of a normal child.

BLAND SUTTON states that in 3000 abdominal sections, covering a period of 20 years, he encountered once the condition of transposition of the viscera, but not in conjunction with cholelithiasis.

VISCERUM INVERSUS WITH GALL-STONES

In the *Transactions of the Berlin Medical Society*, January 25, 1905, KEHR reports in ten years' experience, with 10,000 autopsies, he has found situs viscerum inversus twice.

GEIPEL in an exhaustive study, "Ein Beitrag zur Lehre des Situs Transversus," does not add any further cases pertaining to this condition.

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CARCINOMA OF THE SMALL INTESTINE

WITH THE REPORT OF A CASE EACH OF THE JEJUNUM AND OF THE ILEUM

By Frank H. Lahey, M.D.

of Boston, Mass.

Assistant Professor of Surgery, Tufts Medical School, Third Assistant Visiting Surgeon to the Boston City Hospital

That carcinoma of the small intestine is uncommon is evidenced by the rarity of its appearance at the autopsy table.

Nothnagel at the Vienna General Hospital between 1882 and 1893, in 24,358 autopsies, observed 243 cancers of the bowel, and of these but 6 were of the ileum and none of the jejunum.

Lubarsch at the Pathological Institute of Breslau between 1878 and 1891 observed 42 cancers of the bowel, 2 in the ileum and none in the jejunum.

Fr. Müller in the Pathological Institute of Bâle in 11,314 autopsies observed 123 cancers of the bowel, of which 2 were of the ileum and none of the jejunum.

Max Müller in the Pathological Institute of Berne between 1866 and 1897 in 5621 autopsies observed 41 cancers of the bowel, 3 in the ileum and jejunum.

There are many more pathological statistics which might be cited, but from the foregoing it is sufficiently evident that carcinoma of the small intestine and particularly the jejunum is an uncommon condition.

Only 23 cases had been reported up to 1906 but in the last few years the number has risen rapidly, until in a very comprehensive study of the subject, Venot and Parcelier [1] have collected and reported in detail 50 such cases.

It is the writer's wish to add to this list the two cases cited below, one a cancer of the jejunum and one a cancer of the ileum.

Case I.—Mr. C., aged forty-five. Towerman. Examined January 17, 1914. Referred by Dr. R. D. Elliott. Was operated for fistula in ano 4 years ago. Otherwise well up to present trouble. No liquor or tobacco. Has one daughter twenty years old, strong and well. Wife has had one miscarriage at the second month of pregnancy. Denies syphilis and gonorrhœa.

Six months ago stomach began to bother him, causing distress with everything eaten. He describes his feeling as distress in the stomach region, coming only after eating or drinking. At this

same time he began to complain of loss of strength, particularly weakness in the legs. In a month from this time began to vomit occasionally after eating, and after vomiting discomfort was relieved. Since last August has had an increasing pallor which has kept pace with his loss in weight. Has also had a good deal of difficulty in obtaining a bowel movement, necessitating the frequent taking of castor oil. The vomiting has increased in frequency until now he vomits every two or three days. Best weight, 195 pounds; now weighs 181⅜ pounds. Has never vomited any blood or passed any dark-colored stools. No "heartburn." Since taking olive oil of late, patient thinks that he has had less discomfort after meals.

Is well-developed and nourished. Cachectic in appearance. Hæmoglobin 70 per cent. Eyes, tongue, neck, lungs, heart and extremities do not present anything unusual or abnormal. Liver apparently not enlarged. Spleen not palpable. Abdominal examination shows considerable tenderness over the area occupied by the splenic flexure or just internal to it. Here there is felt a hard movable mass apparently small but indefinite in outline on account of its depth. The mass ascends and descends little or none with respiration, but is freely movable. Temperature normal. Pulse 84. Urinary examination negative.

A provisional diagnosis of carcinoma of the small intestine was made, and the patient sent to the Deaconess Hospital for operation.

Operation (at the Deaconess Hospital January 19, 1914).—Dr. Burton Hamilton etherizing; Dr. H. G. Webb assisting. A left rectus incision was made over the epigastrium. No mass or masses could be felt on the first exploration with the hand, but on a more careful examination a small tumor which consisted of what appeared to be an annular carcinoma, completely surrounding the bowel, was found in the jejunum about 18 inches from the ligament of Treitz. An intestinal lumen just large enough to admit the finger-tip remained unconstricted. About eighteen inches of bowel with its mesentery was resected, and an end-to-end anastomosis done. The making of the anastomosis was somewhat trying, as the upper end of bowel consisted of the stump of the jejunum so close to the retroperitoneal portion that the passage of sutures was rendered difficult. There were a few glands deep in the mesentery, most of which could be resected. The wound was sewed up in layers. Good ether recovery. Pathological report on specimen: *adenocarcinoma.*

The convalescence was uneventful save for a stitch abscess, and the patient left the hospital on the twenty-eighth day after the operation.

The patient was last seen a few weeks ago, approximately fourteen months after the operation. He has gained 20 pounds in weight, has a good color, no cachexia, and has been working steadily at his occupation as a tower switchman now for several months.

CASE II.—Mrs. C. Four years ago suffered an attack of inflammatory rheumatism. Cough for the last year. Periods ceased at forty-two. For the seven months up to one month ago, bowels have moved 3 to 7 times a day, but for the last month she has been constipated. For the past month has had colicky pains low down on left side of abdomen, and with these attacks of colic the abdomen has become distended. Has vomited but once during the past three months and the vomitus on that occasion was dark brown material, which the nurse thinks might have been blood. Her weight during the past six months has diminished from 128 to 98. There has been no visible blood in the movements. Has been in bed four weeks because of "pain in the abdomen and loss of strength."

She is well-developed and poorly nourished. Despondent. General physical examination negative, except for the abdomen.

Abdomen: Just to the left and slightly above the umbilicus is a freely movable, hard mass, the size of an egg, irregular in outline, and not tender on pressure. This mass may be pushed freely from the left side of the abdomen to the right side, where it does not seem as close to the skin. It also displaces upward and downward freely. Urine examination, negative. Benzidene test for blood in the fæces positive after three days on a meat-free diet.

Operation (at the New England Baptist Hospital).—Etherizer, Dr. E. N. Libby; assistant, Dr. Harold Webb. Incision just to the left of the medium line, extending from below ensiform to umbilicus. A small discrete carcinoma of the small intestine about six feet from the ileocæcal valve found. The growth involved all of the coats of the bowel, and although larger on one side than the other, completely encircled the intestine so that its lumen was almost wholly occluded. There were practically no enlarged glands in the mesentery. An excision of about one and one-half feet of bowel with a wedge-shaped piece of the attached mesentery and an end-to-end anastomosis by suture was made. There was no involvement of the liver or other abdominal organs to be felt. The wound was sutured in layers, and the patient made an uneventful recovery, but died five months later of apparent recurrences in the abdomen. Pathological report on specimen: *adenocarcinoma.*

FIG. 1.—Photograph of section of intestine removed, showing the ring-like form of the carcinoma.

Regarding the appearance of this condition more commonly in either sex, it is quite likely that it is no more common in the male than in the female. Keyser [2] in a collection of 11 cases found 6 in males and 5 in females. Venot and Parcelier, however, found but 30 per cent. in females and 70 per cent. in males.

The average age as given by Keyser was 43.9 years. Venot and Parcelier state that it occurred in the series from 3½ years up to 82 years, but that it was a veritable curiosity up to 30 years.

In practically all of the cases observed, the tumor has been of more or less annular or ring-like form (see Fig. 1), infiltrating all of the layers of the intestinal wall. The specimen in Case II, which unfortunately was not photographed, was somewhat larger on one side than the other, but on the whole similar to the above illustration. There are, however, cases in which this annular form is not taken. One was reported by Curtis [3] in which the mass involved nearly five inches of intestine without obstruction, and another by Keyser in which the intestinal lumen was of the size of a cocoanut.

The symptoms of carcinoma of the small intestine must be in the beginning vague and indefinite, and until either some degree of obstruction or a palpable tumor is present, too uncertain upon which to base a diagnosis at once. Pain in both of the cases here reported was an early symptom and has been in a majority of the other cases reported. The pain in these two cases has been the result of interference with the onward passage of intestinal contents, since in Case I it was spoken of as distress with everything taken, and in Case II as colicky pain attended with distention at the time of the attacks.

It is interesting to observe that in Case I the pain or distress was directly relative to eating, while in Case II, in which the growth was in the ileum, the pain was rather of the nature of intestinal colic or obstruction. Vomiting in these two cases as well as in many of the other cases reported has been a fairly constant factor, and is dependent upon the degree of obstruction present either temporarily or permanently. Constipation in both of these cases has seemed to have been of sufficient importance to cause the patient to remark about it, and has also been prominent in the other cases reported in the literature on the subject. Diarrhœa is said to be much less frequent than constipation. Loss of weight in the first case was of no remarkable amount, although there was a markedly cachectic appearance with the lemon-like coloring so often observed in pernicious anæmia. There was a marked loss of weight in the second case and also in many of the other reported cases. The loss of weight while suggestive of

malignancy, apparently does not appear until obstruction occurs, and so, fairly late in the disease.

Neither of these cases were submitted to X-ray examination because of the palpable tumor, but in suspected cases all agree that the most valuable early evidence may be obtained by this method of examination. The presence of a freely movable tumor as occurred in both of these cases should be suggestive of tumor of the small intestine, because tumors here, provided there are no adhesions, move more freely than those of the large intestine on account of the long mesentery of the small intestine. Examination of the stools for occult blood was made in Case II and found positive. All writers agree as to the value of a positive finding in this connection. The decision in these cases as to the choice of operative procedure should not be difficult, and should be as follows: resection where the tumor is free, lateral anastomosis where too firmly bound down by extensive or dense adhesions for resection, and enterostomy in those cases of acute obstruction operated upon as emergencies.

Prognosis.—It is said by Venot and Parcelier that the prognosis in carcinoma of the small intestine should be less favorable than in carcinoma of the large intestine, yet it would seem in the two cases reported by the writer that the growth of the tumor had been extremely slow, one case having a history suggestive of the growth for six months and the other for eight months. In both cases, too, it may be noted that one of the chief reasons for seeking surgical attention was the symptoms dependent upon obstruction produced by the growth.

If this is the usual type of carcinoma involving the small intestine, and from a perusal of the original articles in which the cases were reported it appears that it is, it seems to the writer that with an early diagnosis it should be a favorable type of intestinal cancer to operate upon, and that earlier diagnosis in this type of growth can be made by submitting these cases with suspicious intestinal symptoms to earlier X-ray examinations.

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DILATATION OF THE DUODENUM

AN EXPERIMENTAL STUDY*

By W. Howard Barber, M.D.
of New York

The coincidence of dilatation of the duodenum and ileac retention is frequently recognized in X-ray studies on gastro-intestinal cases. At operation a dilated duodenum is often found associated with a constriction or angulation or otherwise contracted caudad ileum. These observations [1] have been frequently made by clinical gastro-enterologists apparently without attempting to explain any dynamic correlationship between the muscular or neuromuscular tone of the duodenum and that of the aboral ileum.

Experimentally the problem has presented itself: is there not some causative interplay between incomplete obstruction of the extreme caudad ileum and dilatation of the duodenum? It is commonly known that constipation, long continued, may terminally present the aspects of cæcal stasis. In laboratory terms it is the author's experience that experimentally produced constipation in dogs is followed by the dilated atonic cæcum. In other words, incomplete obstruction of the caudad colon is associated with dilatation and increased dilatability of the cephalad colon. An analogous association has been observed in the ureter.[2] Is there not some functional interdependence of the muscular states of the two ends of the small intestine?

Ochsner's anatomical studies have revealed a concentration of the circular fibres of the duodenum 2.4 cm. aboral to the entrance of the common bile duct. He holds that this "duodenal sphincter" may work in concert with the ileocæcal valve and the pylorus: that an appendicitis stimulates the closure of the ileocæcal valve, giving rise to ileac retention, to closure of the duodenal sphincters, thus favoring duodenal ulcer, to pyloric closure—thus interfering with the normal progress of food.[3] It is significant that in this study, dilatation of the duodenum has been found invariably greatest in the portion cephalad of the common bile duct.

Mr. Lane,[4] on the other hand, explains duodenal dilatation on a mechanical basis, thus, "The accumulation of material in a large pro-

* From the Laboratory of Experimental Surgery, N. Y. U., and Department of Gastro-intestinal Surgery, Polyclinic.

lapsed cæcum" may result in ileac delay and accumulation. Or obstruction of the ileum may be still further exaggerated by an "ileal kink" or by a "fixation of the appendix to the under surface of the mesentery by adhesions." "The *accumulation of the material in the small intestine* drags upon and obstructs the duodenojejunal junction. In consequence the duodenum is elongated and dilated and especially in its first portion where it is free and surrounded by peritoneum." Both authors therefore agree in the importance of ileac retention as a factor in duodenal dilatation, but differ in the mechanism of retention; the former mentioning reflex closure of the ileocæcal valve from appendical irritation; the latter holding to mechanical interference with the lumen of terminal ileum.

Bloodgood [5] differs from the preceding authors in applying mechanical pressure at the point of dilatation. This is described under the capita: (1) Acute gastromesenteric ileus; (2) chronic gastromesenteric ileus, and (3) filling of the duodenal stump after gastro-enterostomy. With this contention Draper,[6] speaking from the stand-point of the Surgical Laboratory at that time, agreed, declaring that "dilatation does not occur in any organ except at the point of obstruction." The dilatation of the first and second portions of the duodenum were believed due to obstruction of the third portion. That the mesentery may exert such pressure has been doubted by Lynch [7] and others. That the pressure presumably exerted may affect an immediate dilatation depends upon the amount of pressure. The obstruction if incomplete must be greater than the potential peristalsis of the duodenum, as appears from experiments on the caudad ileum. Apropos of this dilatating load, Keilty and Smith,[8] in their recent review of 100 human autopsies, express themselves as follows: Stasis "is brought about by rapid reduction of the lumen of the gut without establishment of compensation or with compensation but with increased load producing fatigue and dilatation." Filling of the duodenal stump has been repeatedly observed experimentally. Occasionally this filling may be due to the relation of the oral duodenal loop to the stomach wave.

Dog 224; mongrel; female. Small intestine divided at caudad end of the oral third. Caudad two-thirds were anastomosed at mid-point, with antrum pylori placing stoma parallel with the greater curvature. Five days later greater amount of stomach test-meal that had passed through stoma traced into oral segment; opening into distal segment patent.

Dog 232; mongrel; male. Small intestine divided at same point. Caudad segment 5 cm. aborally anastomosed laterally in same manner to antrum pylori. A^{IV} test substances that passed through the pyloric stoma found in duodenal stump; opening into distal segment patent.[9]

Should the passage into the jejunal segment be occluded certainly the contents of the duodenal segment must be so much the more increased. Hence it appears a pathologic load applied directly to the duodenum by a tensely drawn mesentery or the over-filling of the duodenal stump following gastro-enterostomy by the peristaltic stomach wave may dilate the proximal duodenum.

Christian [10] quoted Ochsner and Bloodgood and assumed duodenal atrophy to be associated in some way with gastric atony and pyloric relaxation.

It is generally agreed that mechanical obstruction [understood to be qualified as above described; this virtually amounts to a complete physiological obstruction] of the duodenum may give rise to immediate duodenal dilatation and that incomplete mechanical obstruction of the extreme caudad ileum from adhesions incident to appendicitis or surgical stasis is *occasionally coexistent with* mediate dilatation of the duodenum.

A number of animal experiments have been performed to determine a possible causative relationship of incomplete caudad ileac obstruction to dilatation of the duodenum. The ileum, 3 cm. from the ileocolic junction, was loosely ligated with gauze, so that the resultant potential lumen of the ileum within the gauze was equal to the lumen of the relaxed ileum. In a few of the animals a segment of ileum 8–10 cm. cephalad of the ligature was demarcated by a linen suture run through the seromuscular wall and loosely tied. A duodenal segment of equal length in every dog was defined by a similar suture an equal distance caudad of the pylorus. In order to decide definitely on the presence or absence of dilatation in all the latter dogs, each loop was injected with water from a 2 c.c. syringe, with intermuscular needle, until the injecta reappeared at the detached end of the needle on disconnecting the syringe. The ends of the outlined loops were compressed digitally during the filling of the segments. The amount of injected fluid was taken as a measure of the potential size or dilatability of each intestinal segment at the time of distention.

Dog No. 19; bull; male. October 29, 1914: Ileum compressed by gauze strip, 2 cm. in width; sutured end-to-end and, snugly, about walls of ileum 2 cm. from ileocolic junction.

November 5, 1914: Dilatation of duodenum for cephalad 12 cm.

Dog No. 112; mongrel; male. December 3, 1914: Caudad ileum compressed by gauze in similar manner.

December 9, 1914: Was operated upon for other reasons, and duodenum was noted dilated.

Dog No. 131; mongrel; female. December 10. 1914: Terminal ileum incom-

pletely resected for 2 cm. and reconstructed with a diameter of one-half original size.

January 17, 1915: Marked dilatation of duodenum.

Dog No. 149; mongrel; male. February 4, 1915: Caudad ileum ligated by moistened gauze strip so that resulting lumen measured approximately 1 cm. in diameter. Duodenum defined 10 cm. caudad by a linen seromuscular suture. Dilatability 14 c.c.

February 9, 1915: Duodenum dilated. Dilatability 19 c.c. Stomach contracted, colon dilated.

February 13, 1915: Duodenum dilated for 15 cm. caudad of pylorus. Dilatability 24 c.c.

Dog 179; mongrel; male. February 4, 1915: Caudad ileum obstructed incompletely by gauze band. Duodenum defined at arbitrary caudad plane by linen suture. Duodenum dilated. Stomach small. Dilatability 10 c.c.

February 9, 1915: Duodenal dilatability 22 c.c.

February 16, 1915: Duodenum buried in adhesions, freed, and admitted but 9 c.c. Adhesions undoubtedly interfered with further dilatability.

Dog No. 223; mongrel; female. March 9, 1915: Caudad ileum ligated with gauze strip; 8 cm. cephalad of ligature defining suture of linen inserted. An equal segment of duodenum similarly defined. Dilatability of ileal segment 10 c.c., duodenal segment 14 c.c.

March 18, 1915: Ileum cephalad of gauze ligature impacted with fæces for 10 cm., which converted the incomplete into a complete ileac obstruction. Under this condition dilatability of duodenum was 6 c.c. and of ileum 60 c.c.

Dog No. 251; mongrel; male. March 27, 1915: Extreme caudad ileum ligated with gauze, without encroaching upon lumen of gut as found in relaxed state. Duodenal and ileac segments defined as above. Dilatability of duodenal segment 9 c.c. and of ileac 6 c.c.

April 1, 1915: Ileac loop contained small amount of pasty fecal material cephalad of ligature. This was emptied before injection. The apparent dilatation of either loop was negligible. Dilatability of duodenal segment 10 c.c.; of ileum 8 c.c.

Dog No. 252; mongrel; male. March 27, 1915. Similarly treated. Animal had mucopurulent nasal discharge and tonicity of intestine appeared very low. Ileum ruptured longitudinally while being injected. Died 36 hours later of pneumonia. Dilatability of duodenum on March 27 14 c.c.; of ileum 12 c.c. At autopsy duodenum showed no change.

Dog No. 259; mongrel; male. April 1, 1915. Similarly treated. Dilatability of duodenum 14 c.c.; of ileum 8 c.c. (loops of unequal lengths).

April 6, 1915: Duodenum dilated by inspection, dilatability 20 c.c.

Ileum enveloped in adhesions not dilated and ruptured when injected to capacity of 14 c.c. Gauze removed.

April 8, 1915: Duodenum appeared more dilated, but held 12 c.c. only. Ileum showed productive inflammatory change; held 3 c.c.

Dog No. 260; mongrel; female. April 1, 1915: Used as control. No obstruction but loops demarcated and injected.

Duodenal dilatability 10 c.c.; ileac dilatability 8 c.c.

Marked contraction of distended ileac segment followed immediately upon

release of distention. A contractile wave appeared subsequently in cæcum and cephalad colon.

April 6, 1915: Ileocolic intussusception found and released. Under these conditions duodenum was noted not dilated and capacity found to be as above, 10 c.c. *Completely obstructing ligature placed about ileum cephalad of injured portion.*

April 8, 1915: Duodenum *apparently* dilated greatest at region of common bile duct entrance and traceable to 2 cm. caudad. Dilatability only 4 c.c. Ileum seriously damaged and impacted for 10 cm. cephalad to ligature.

Dog No. 264; fox terrier; male. April 6, 1914: Incompletely obstructed at terminal ileum 2 cm. cephalad of ileocolic junction. Dilatability of duodenum 10 c.c.; of ileum 10 c.c.

April 13, 1915: Adhesions about defining sutures. Ileum kinked by omental adhesions. Duodenum *contracted*, capacity 4 c.c. Ileum unchanged.

Dog No. 265. April 6, 1915: Control treated in the same manner with the omission of obstructing ileac ligature. Dilatability of duodenum 18 c.c.; of ileum 8 c.c.

April 13, 1915: Duodenum and ileum grossly unchanged. Dilatability of duodenum 10 c.c.; of ileum 6 c.c. *Completely obstructing ligature placed about caudad ileum.*

April 15, 1915: Duodenum contracted. Dilatability 6 c.c.

To determine a possible causative relation of cæcal stasis to dilatation of the duodenum as suggested by Lane, the following experiment was performed:

Dog No. 266; mongrel; male. April 8, 1915: Colon 2 cm. caudad of ileocolic junction ligated loosely, leaving potential lumen 1 cm. Duodenal segment defined and found dilatable to 14 c.c; cæcum dilatable to 12 c.c.

April 13, 1915: Duodenum unchanged, held 12 c.c. Cæcum not grossly changed, held 8 c.c. Completely obstructing ligature placed about terminal ileum.

April 15, 1915: Duodenum contracted, held 6 c.c. Colon distended with gas and dried fæces.

To determine the possible causative dilatation of duodenum by appendicitis, the following experiment was performed:

Dog No. 267. April 8, 1915: The cæcum of the dog, similar in many respects to the occasional funnel-shaped human cæco-appendix, was injected with an emulsion of another dog's fæces and firmly ligated 5 cm. cephalad of tip. Duodenal loop defined and injected to 14 c.c.

April 13, 1915: Ruptured gangrenous cæcum and diffuse purulent peritonitis. Stomach unchanged. Duodenum unchanged, dilatability 8 c.c. Caudad ileum unobstructed.

Under the conditions of the foregoing experiments the following observations therefore have been made:

(1) Incomplete obstruction of the extreme caudad ileum gives rise to dilatation and increased dilatability of the cephalad duodenum.

(2) Complete obstruction of the extreme caudad ileum gives rise to no apparent change and decreased dilatability (or perhaps increased tonicity) of the cephalad duodenum.

(3) Incomplete obstruction of the cephalad colon or purulent typhlitis gives rise to no apparent change and decreased dilatability of the cephalad duodenum.

The researches of Alvarez,[11] Gerlach,[12] and Biedermann[13] have contributed certain important data bearing upon the relations of the duodenum with the caudad ileum. Alvarez made the following significant observation from his studies on intestinal segments of rabbits: "In removing the segments it was found best to begin at the

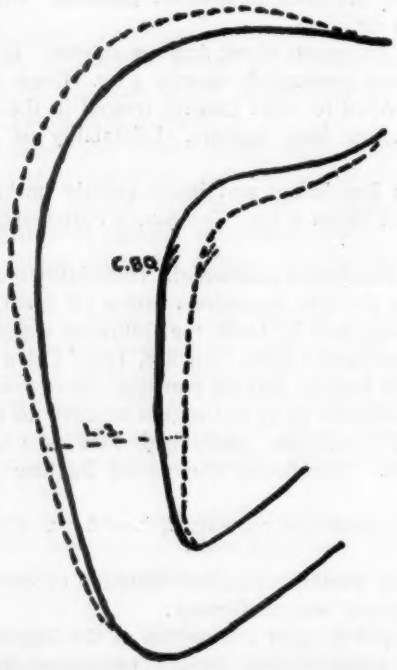

FIG. 1.—Diagram representing normal duodenum in full, and dilated duodenum in broken, line. In experiments presented the duodenum of mean volume of 12.2 c.c. dilates to a mean volume of 19.2 c.c. in 5.8 days, following a fixed potential diameter of caudad ileum of approximately 1 cm. (or incomplete obstruction). *C. B. D.*, common bile duct; *L.S.*, limiting suture.

pylorus and to proceed downward, as the bowels soon became distended and atonic after ligation of the ileum. When this happened segments from the duodenum did not beat well—the amplitude was poor, the rhythm was irregular, and fatigue appeared early." Gerlach has found considerable variation in the thickness of Auerbach's plexus in different parts of the intestinal tract. In the first 5–6 cm. of the duodenum he observed the largest fibres intermingled with the greatest number of ganglion cells. Below this point, which possibly corresponds with the site of Ochsner's "duodenal sphincter," the fibres gradually lost their

cells and the meshwork became wider. Upon this nerve-net, according to Biedermann,[15] depend the rhythm and size of the peristaltic waves.

The whole neuromuscular arrangement appears quite analogous to that described for the ureter by Bardeleben,[14] and no doubt furnishes adequate anatomical explanation for the analogous physiological mechanisms of the small intestine and the ureter.

It is extremely difficult and hazardous to correlate all this experimental and anatomical material. It is evident, however, that an incom-

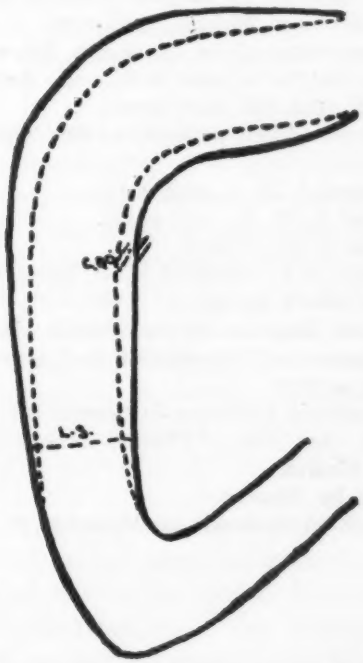

FIG. 2.—Diagram representing normal duodenum in full, and contracted duodenum in broken line. In experiments presented, duodenum of mean volume of 14 c.c. contracts to a mean volume of 6.25 c.c. in 5 days following a fixed potential diameter of caudad ileum of 0 (or complete) obstruction. *C. B. D.*, common bile duct; *L. S.*, limiting suture.

plete obstruction permits the free intercommunication of the duodenal and cæcal centres through Auerbach's plexus, whereas a complete obstruction interferes with such relationship. Furthermore abnormal cæcal stimuli, whether from an inflammatory appendix or an incompletely obstructed cæcum, may have the same cumulative effect upon a duodenal centre as does the abolition of all such stimuli together. In other words, we should expect in the first case (incomplete ileac obstruction) a duodenum laboring to the points of fatigue and dilatation under

a plus physiologic load, and in the latter case (complete ileac obstruction, incomplete cæcal obstruction, and typhlitis) a conservation of duodenal contractile power and a more tonic duodenum.

The author is indebted to Prof. G. S. Huntington for his constructive criticism of this paper.

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CONTRIBUTION TO THE SURGICAL PHYSIOLOGY OF THE COLON*

By Jerome Morley Lynch, M.D., and John William Draper, M.D.
of New York

and

T. W. Lyon, M.D.
of New Haven

(From the Clinic of Rectal and Colonic Diseases, N. Y. Polyclinic School and Hospital and from the Surgical Research Laboratory of New York University, N. Y.)

There are three modes of approaching the study of functional abnormalities in the human colon. The first is based upon the influence of heredity and environment, and may therefore be looked upon as biologic in character. The second is based upon facts gleaned through experiments upon the lower vertebrates, through the help of which a good deal may be learned regarding the surgical physiology of the part, and these studies may properly be supplemented by biochemical observations upon human beings in whom the path of the ingesta has been shortened, as, for example, by ileostomy. The third source of information is to be had by a critical clinical interpretation of the subjective and objective changes in human beings observed before and after therapeusis.

It seems clear to the essayists that our knowledge of the colon at this early day is not far enough advanced to justify any exclusive claim for the furtherance of this or that special form of therapy, be it so-called medical or so-called surgical. They therefore present herewith certain data, gleaned as outlined above, in the hope that it may be of use to others as a basis for inductive study, and in the conviction that time and a wider acceptance of the fundamental sciences will soon bridge the rapidly narrowing channel which unfortunately still separates the therapeusis of the physician from that of the surgeon.

Man alone among the mammals possesses the highest intelligence and the most unstable digestion. There are two important phylogenetic reasons for this, and these are often supplemented by errors in ontogenetic development. Until birth he is the variable product of two forces: those hereditary tendencies resident in the germinal material itself, lasting throughout his life, and those imposed upon him by

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the peculiar conditions of his environment during the period of gestation and continuing more or less until death.

Phylogeny ordains that man shall often bear a heavy, segmented colon, semi-herbivorous in type, and that he shall walk upright. The herbivorous colon is obviously designed to be supported by the anterior parietes; man's habits of life deny this support and subject the badly and imperfectly suspended organ to the pull of gravity for at least half of his life. Shaler [1] considers that the upright position has been paramount among all other factors in fixing the length of the life of man.

Ontogeny furnishes many opportunities for faulty growth and position. On account of the very complex human development, during which the individual fœtus must follow a narrow and devious path of extreme antiquity, there are innumerable opportunities for arrested or irregular form.

Man, in other words, while following his long and complex course of development, is swayed by two differing forces, heredity and environment. An appreciation, therefore, that even in his alimentary canal he is the product of these complex forces must be helpful in understanding the maze of adult variations of form, position, and function, which confront the student of gastro-enterology. Our course of reasoning must be changed from the deductive to the inductive form of thought. Deficiencies in type must be recognized by the diagnostician early in life if therapy is to hope to make amends for nature's shortcomings in any given individual. In the purest type you can collect, there are hundreds of species.

Wiedersheim has collected one hundred and eighty variants of the hereditary type in human beings. The persistence of the lanugo as seen in the Russian dog men, or of the palmar muscle which enables babies to support themselves from a rod and grown men to bend small coins, and which normally disappears, are excellent examples of the tenacity of early characteristics. How logical it is, therefore, to trace many of the colonic variations which we know invite disease to the persistence of embryonic conditions which may be much less remote in the evolutionary scale, and, because of modern facilities such as the X-ray, just as easily demonstrated. The old-fashioned notion as to inheritance of heart and kidney disease, discredited on the ground of non-transmissibility of acquired conditions, may really be due consideration if it be true, for example, that colonic toxæmia is a factor in the causation of sclerosis. Evidently, in these days of preventive

[1] Shaler: Individual.

medicine when the pressure in the social fabric is so acute, and when, just because of our rapid evolution, a very highly developed individual may mate with one of lowly heredity, it must become an engrossing task to find therapeutic methods wherewith to meet and offset the products of disregard of the laws of eugenics. Many a poor, ill-conditioned, clammy-handed child, backward in its studies, seemingly lazy, inefficient, and ill-tempered, is, in light of recent knowledge, not intrinsically delinquent or even intellectually deficient, but often the unhappy result of a congenital dysmorphia of the stomach or cæco-colon. Such defects may be, as stated, due to the inheritance of characteristics unsuited to the human type.

Comparative anatomy [2] of the vertebrates supports the hypothesis of developmental relationship between cæcum and stomach. For example, in the horse, the cæcum and cæcal colon are well developed and complex, the stomach being simple; on the other hand, in ruminants, as the cow, the stomach is complex while the cæcum is simple.

In carnivora the cæcum is naturally small and rudimentary, while in man, who leans to the side of the carnivora, the cæcum probably is of little use and is normally small. Nature has made no provision for an over- or ill-developed cæcum in man, the stomach having taken its place. However, the cæcum not infrequently takes on the herbivorous type. This has all the disadvantages and lacks the delicately adjusted mechanism and advantages of the true herbivorous form. Clearly then this cæcum, from the stand-point of development and usefulness, becomes not alone useless to the human economy, but actually detrimental to it. Such a condition is not to be wondered at when one considers that very divergent developmental paths have been taken by the individual and by its aberrant organ. Bryant [3] has put the classification of human beings into herbivorous and carnivorous upon a firm basis. Furthermore, normally limited in circulation, when the cæcum is over-developed, the blood supply is extremely deficient and weak. As its motility is impaired and its morphology perverted, its current slows and it begins to harbor and to disseminate the unidentified but definitely proven toxic substances which result, indirectly, in disease.

The weak point in the small gut is the duodenum, for its support is deficient. Dilatation often occurs here and may be in turn transmitted to the stomach. Barber's [4] studies show the relation of the

[2] Keith: Human Embryology and Morphology.

[3] Bryant: The Carnivorous and Herbivorous Types in Man, Boston Med. and Surg. Jour., March 4, 1915.

[4] Barber: Dilatation of Duodenum, ANNALS OF SURGERY, October, 1915, p. 433.

autonomic system to dilatation and are not in direct accord with the views of those who consider the mechanical factor of support, or traction upon the mesentery as paramount. He has demonstrated by a series of animal experiments the different effects upon any tube in the body of partial or complete obstruction. Briefly, partial obstruction of the ileum results in duodenal dilatation, whereas complete obstruction is followed by duodenal contraction and ileac dilatation at the point of obstruction. He has also shown that a close correlation exists between the ileocæcal and the uretero-vesical valves as regards their importance to the economy. His conclusions, shortly to appear in the ANNALS OF SURGERY, are as follows:

"The whole muscular arrangement appears quite analogous to that described for the ureter by Bardeleben, and undoubtedly furnishes adequate anatomical explanations for the analogous physiological mechanism for the small intestine and the ureter.

"It is extremely difficult and hazardous to correlate all this experimental and anatomical material. It is evident, however, that an incomplete obstruction permits the free intercommunication of the duodenal and cæcal centres through Auerbach's plexus, whereas, a complete obstruction interferes with such relationship. Furthermore, abnormal cæcal stimuli, whether from an inflamed appendix or an incompletely obstructed cæcum, may have the same cumulative effect upon a duodenal centre as does the obliteration of all such stimuli together. In other words, we should expect in the first case (incomplete ileac obstruction) a duodenum laboring to the point of fatigue and dilatation under a plus physiologic load, and in the latter case (complete ileac obstruction, incomplete cæcal obstruction, and typhilitis) the conservation of duodenal contractile power and a more tonic duodenum."

Turning to the development of the individual colon we find certain critical periods which may be classified as follows: The first coincides with the appearance of the buds from the vitelline duct, from which are developed the hind- and fore-gut. The second is at about the third month when, normally, the bowel rotates. The third is the period of adhesion or fusion, after birth.

The stomach and cæcum have but two important functions, those of storage and motility. All others are negligible. Because of normal man's leaning toward the carnivorous type and diet, and because of his upright position and numerous environmental factors, the cæcocolon, so to speak, has outlived its usefulness, being but a vestigial remnant of the organ so essential to the herbivora. We do not find that this is true of the remainder of the great gut.

Any other function possessed by the ascending colon and cæcum can be cared for by the caudad ileum. This is reasonably to be explained upon a biologic basis, for although differing widely in form, they have a common embryological origin.

In general, then, we may assume that the acquisition of certain intestinal malformations is evidence of hereditary predisposition. Some ill placed individuals, as we shall show later, yield to it, others do not. A plausible hypothesis as to the frequent occurrence of an ill adapted pseudo-herbivorous cæco-colon in man is perhaps that his remote ancestors were very imperfect in type and that these have perished. Mutations may arise *de novo,* and we are ignorant regarding their source. Man was unquestionably dark originally, the albino being a mutation.

All digestion takes place between the pylorus and the caudad ileum. Even the absorption of water, we have shown in our human experiments by ileostomy, not to be obligate as regards the colon. The reaction is acid in the ileum and alkaline in the cæcum. Human beings, after ileostomy, gain weight and pass solid fæces and odorless gas.

The basis for the foregoing is as follows: Case 180 (Lyon). Ileostomy for multiple polyposis, April, 1912. Six months after operation stool examinations showed nothing unusual except carbohydrate fermentation and a decidedly Gram-negative bacterial flora. The only enzymes found were amylopsin, decided, and steapsin, a faint trace. This has been confirmed by MacFaydyen, Nencki, and Sieber.[5] The reaction was tested daily for over a year and was found to be always acid. This is also supported by the authors above cited. They state, "Of noteworthy significance was the acid reaction throughout the whole length of the small intestine due to organic acids, chiefly acetic acid. The milk acids are neutralized by the alkaline producing mucosa. The neutralization of the HCl of the stomach takes place in the upper portion of the duodenum." Authors never found HCl. "All analyses showed that secretion of the small intestine contains natroncarbonate, and it was interesting to see in this patient how the mucous membrane of the ileum was alkaline in reaction but the contents acid. Alkaline reaction of the mucous membrane of the colon was much more intensive than that of the ileum. The alkaline reaction of the chyme begins in the large intestine." The importance of these observations, which are in accord with our own as regards bacterial growth in the ileum, cannot be overestimated.

[5] MacFaydyen, Nencki, Sieber: Archive für Exp. Path. and Pharm., 1891, vol. 28.

Ileostomy affords opportunity for critical study of the accuracy of X-ray findings as regards motility. There appears to be a difference in the time taken by bismuth and by ordinary food-stuffs to reach the cæcum. It is reasonable to expect a difference, bismuth being a substance foreign to the gut. Of the one hundred and sixty-four feeding experiments checked by carmine and charcoal made by Dr. Lyon, upon himself, the average time of first appearance at the stoma was 4 hours 57 minutes, the maximum being 6 hours, the minimum 4 hours 15 minutes. Addition of agar-agar gave 3 hours 45 minutes. Average time total emptying 11 hours 56 minutes; maximum 14 hours 30 minutes; minimum 8 hours 30 minutes. Consistency varied with food as follows: Meat diet yielded liquid stools; carbohydrate solid.

The following quotation from Dr. Lyon's observations upon himself are valuable. Shortly after operation and evidently before establishment of the vicarious compensation already referred to, he says, " Intense thirst generally during evening. After drinking eight or ten glasses am satisfied. At such times noted no change in the movements. Chicken and turkey leave more undigested muscle fibres than any other foods. Riding on trains always delays motility. Bananas of great value when bowel is sluggish."

One of the most interesting physiological observations to be made after an ileostomy has bearing upon referred pain. If the finger is passed into the ileac stoma or through the valve, pain occurs at the umbilicus and frequently over the splenic flexure. Nausea always and vomiting sometimes results.

Accidentally a concentrated stock solution of sodium chloride was poured into the colostomy of a physician. Severe pain in pit of stomach, shock, and collapse resulted. Intense thirst for 24 hours was followed by gradual recovery. After ileostomy, patients are able to detect immediately the entrance of even the smallest particle of ileac contents into the resting colon. Dr. Lyon found that dizziness, faintness, and cold sweats were the invariable subjective symptoms of this accident. The same symptoms but in less degree were brought on by inserting the finger into the colon. Every patient upon whom we have done ileostomy has experienced the same symptoms. Is it unreasonable to assume that certain of the familiar symptoms of so-called colonic toxæmia may be due to analogous mechanical conditions, whatsoever these may be?

In conclusion, we believe that the influence of heredity and environment upon the functional abnormalities of the human colon is paramount and that these fundamental biological factors are due further consideration. Attributing pathological conditions of the colon to any

single factor is a grave error, as isolated deficiencies may be compensated for. In the lower vertebrates, surgical physiology of the valvular mechanisms of the body proves that many complicated factors go to maintain the balance. The valve is the first line of defence; the physiological integrity of the tube is the second. Symptoms will not necessarily follow impairment of one; a valve is useful but not essential. In man, laboratory studies show that no matter how severe the derangement within the bowel, so long as compensation is maintained the body is protected; let the defensive power be weakened, however, and symptoms immediately arise. An excellent example of this has been noted by Bloodgood in his differing results following colonic resection for malignancy and benignancy.

Symptoms, therefore, are often misleading and in themselves are an inadequate basis upon which to form opinions for diagnosis. They must be carefully correlated with the facts of the fundamental sciences and their absence does not necessarily mean normal function.

CASE HISTORY.—*Pre-operative Data.*—Typhoid 17 years ago. One year later diarrhœa, 7 to 8 liquid stools a day. No blood. Winter intermission. This occurred for 3 summers. Total intermission for 5 years. Winter intermission until 1911. Then alternate diarrhœa and constipation. Noticed blood for the first time. Ten to 20 stools a day. Severe colicky pain relieved by stool. Localized at splenic flexure and left ileac region. Obliged to give up work owing to extreme nervousness and loss of mental coördination. Great physical prostration—in bed for weeks at a time.

Operation.—Complete ileostomy.

Post-operative Data.—1. Cessation of pain except at irrigation. This gradually disappeared.

2. Subjective symptoms: *Attacks of faintness,* clammy sweat, cold extremities, weakness and great prostration. Pulse rapid and at times irregular. In 8 minutes desire to defecate followed by small muco-sanguinous discharge with some relief of symptoms. Average duration of attacks 3 hours. Frequency of attacks: Varying from 1 to 3 a week, depending upon the amount of work done. These diminished in frequency and ceased after 6 months. Introduction of foreign body at stoma into resting colon caused same symptoms.

3. Thirst: Intense thirst for first 2 months gradually disappeared as movements became solid. Shows vicarious assumption of colonic function by ileum.

4. Urine: Until solidity of stool, urine markedly diminished. After solidification about 800 c.c. Nitrogen partition made one

year apart at Cornell and Yale Laboratories showed normal metabolism.

5. Sense of fecal discharge: Absent until solidification of contents, and more marked after contraction of stoma. Never painful.

6. Character of stools: Formed stools and often segmented showing layers of food stuffs.

7. Reflex: Occasional cardiospasm with burning sensation in stomach. Occurs once or twice a month without apparent cause, lasting for 2 or 3 days; disappears spontaneously.

8. Rectal discharge: First 6 months irrigations every 12 hours. Some bloody mucus without pain, always from the rectum, passed between these intervals. Second 6 months, irrigations every 24 hours. No discharge except when voiding irrigation. Second year, daily irrigations, practical cessation of blood, and diminution of mucus. End of third year, comfort with bi-weekly irrigations. Discharge reduced to small amount of mucus with very occasional small blood clot.

9. Work capacity: Mental, carrying on regular professional duties. Restoration of normal mental coördination. Complete physical restoration. Able to walk ten miles or row a boat all day.

10. Food: Intense hunger first year after operation, three heavy meals a day. Second and third year normal appetite, food requirement about one-half what it was the first year.

11. Effect of ordinary foods: Nothing ordinarily interferes with solidity of stool.

12. Effect of tainted food: Ileostomy prevents the pain of so-called ptomaine poisoning, the first symptom being continual liquid stool.

13. *Dressing.*—Once a day on arising at time of irrigation. No further attention until 3 P.M. Bag then emptied, it contains the breakfast. Usually again at 8 P.M. This contains lunch. And again upon retiring, this contains part of dinner. Dressing consists of zinc oxide ointment and powdered starch. Night dressing: Cover abdomen with zinc oxide and powdered starch, make a quadrangular space with three-inch cotton roll, stoma at centre. Cover with a layer of cotton, hold in place with a roller bandage over which place a many tailed bandage.

14. Mechanical device: A Delatour apparatus modified to prevent obstruction due to kinking of bag when sitting upright.

15. Gain in weight: First year 17 pounds; second year 6 pounds; third year stationary; total gain 23 pounds.

16. Conclusions: After solidification of the fæces, which occurs in six weeks, there is so little discomfort from an ileostomy as compared to relief from cessation of symptoms, that we unhesitatingly advise its employment.

Additional Data.—Stool: 1. Odor: A slight sour odor never offensive; no fecal odor.

2. Reaction: External surface of fæces alkaline; centre acid.

3. Color: Varied with diet. Meat, dark brown. Potato, dark brown. Baked beans, apples, turnips, light brown. Spinach, string beans, green. Crackers, oatmeal, bread, milk, light yellow. Eggs, black.

4. Form of stool: At first liquid; in six weeks some formed stools. At the end of third year all formed except upon liquid diet.

5. Segmentation: At the end of three years the stools showed little segmentation.

6. Marking of stool: A capsule of carmine, .3 grammes or charcoal given just previous to the meal. Or certain foods, as peas or corn, whose cellulose envelope remained undigested.

7. Time of appearance of foods: In 164 observations on a mixed diet the average time of first appearance was four hours and fifty-two minutes. Shortest time three hours and forty-five minutes. Longest time six hours.

8. Time of complete passage: In 164 observations was eight hours, thirty minutes was the shortest time, and fourteen hours the longest, the average being about ten hours and thirty minutes.

Diet	First appearance	Last appearance
Turkey, potato, turnip, bread	4 hrs. 30 min.	9 hrs. 30 min.
Steak, mashed potato, bread	5 hrs.	11 hrs.
Scrambled eggs, toast, coffee	5 hrs. 15 min.	11 hrs.
Roast veal, potato, bread, lima beans	4 hrs. 50 min.	12 hrs.
Roast lamb, potato, bread, boiled rice	4 hrs. 15 min.	9 hrs. 30 min.
Sausage, wheat cakes, coffee	4 hrs. 40 min.	12 hrs.

9. Time of movements: No regular time, but began from four and one-half to six hours after ingestion and continued until all had passed.

10. Test for enzymes: Amylose, very marked reaction; steapsin, faint reaction; trypsin, negative.

Solidity of stool: From 11 to 13 per cent. solids on mixed diet.

12. Absorption from colon: Thirty grammes of dry peptonoids in two ounces of water injected into rectum in knee-chest position at 11 P.M. Washed out with sterile water at 8 A.M., examination showed one-half of the sugar and nitrogen had disappeared. There was marked fermentation and therefore probably little absorption. Analysis of dry peptonoids:

Protein (N. 6.25) (probably amino acids)	39.81
Carbohydrates (mostly lactose)	50.05
Water	4.72
Ash	5.32

Fats—extremely small.

13. Effects of bismuth: Patient given a meal and time of appearance noted. The next day the same meal preceded by one-half ounce of oxychloride of bismuth. Time of first appearance showed delay of one-half hour. When one ounce was taken the delay was five hours.

Experimental meal .....appeared in 4 hrs. 45 min.
Experimental meal plus one-half ounce bismuth.appeared in 5 hrs. 15 min.
Experimental meal plus one ounce bismuth....appeared in 9 hrs. 45 min.

Lemonade: A glass of lemonade caused an increased flow of bile as shown by abundant dark green liquid at stoma.

Cathartics: One-half ounce of Epsom salts caused a liquid stool at stoma in about two hours.

THE TRIANGLE OF PETIT IN KIDNEY SURGERY

By Hugh Crouse, M.D.
of El Paso, Texas

It is a grave mistake for a surgeon to attempt to adapt the patient to the technic instead of the technic to the patient, for it is not presumed that any single technic holds good in all forms of pathology in structures requiring surgical intervention. This article deals with a new route for kidney surgery, which, in the author's experience, has been successful in most pathological conditions met while dealing with the kidney in a surgical way, and is properly denominated the triangle of Petit route.

To utilize this route, make the skin incision as illustrated in (*A*) Fig. 1, starting about three-fourths of an inch below the twelfth rib, slightly posterior to the anterior border of the latissimus dorsi; sweep straight down to within 1 inch of the crest of the ilium, then forward in a semilunar curve to about 2½ centimetres below and in front of the anterosuperior spine of the ilium. This incision should extend through the skin and adipose tissues only, retraction of which will expose the triangle of Petit at the lower portion of the straight incision, just as it begins to sweep forward. The anterior border of this triangle is formed by the external oblique muscle, the posterior border by the latissimus dorsi, and the inferior border by the crest of the ilium. The anterior floor of this space is formed by the internal oblique, the posterior border of which muscle is slightly anterior to or even with the anterior edge of the latissimus dorsi. When these muscles bounding the triangle of Petit have been exposed, the fingers of each hand of the operator should be forcibly pushed through the space between the external oblique and the latissimus dorsi, and the muscles forcibly and widely retracted; this retraction readily exposes the next structure—the lumbar fascia. The hands then being removed, forcible retraction of this area is made by the assistant, while the lumbar fascia is incised or nicked by the operator; in many cases this fascia can be punctured readily by the index finger, thus avoiding aid from the assistant. Again, with the fingers of each hand forcibly separate the latissimus dorsi, external oblique and lumbar fascia. Substitute a 3-bladed automatic retractor of the abdominal type for the fingers, with the auxiliary blade at the superior angle of the triangle of Petit, or the space made by the hand retraction of the operator;

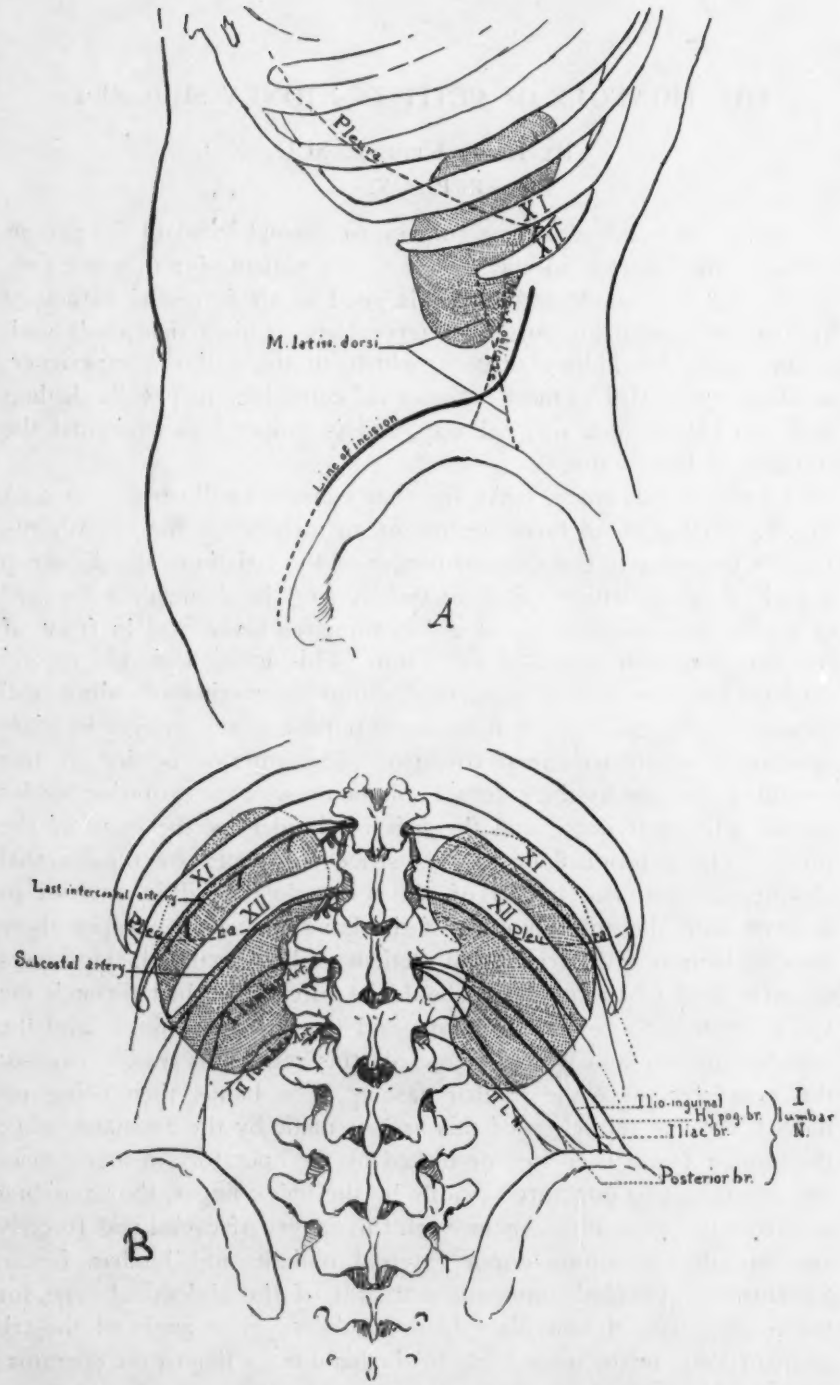


FIG. 1.—*A*, showing author's incision and schematic illustration of muscles and parts forming the triangle of Petit. *B*, illustrating nerve and blood supply in lumbar region liable to injury during operation.

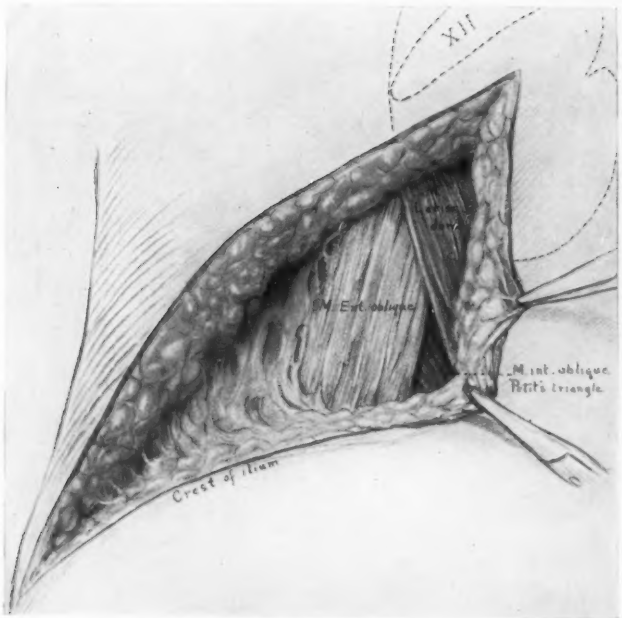


FIG. 2.—Skin incision separated, showing the triangle of Petit, the muscles and crest of ilium bounding it.

FIG. 3.—Fingers of operator making retraction.

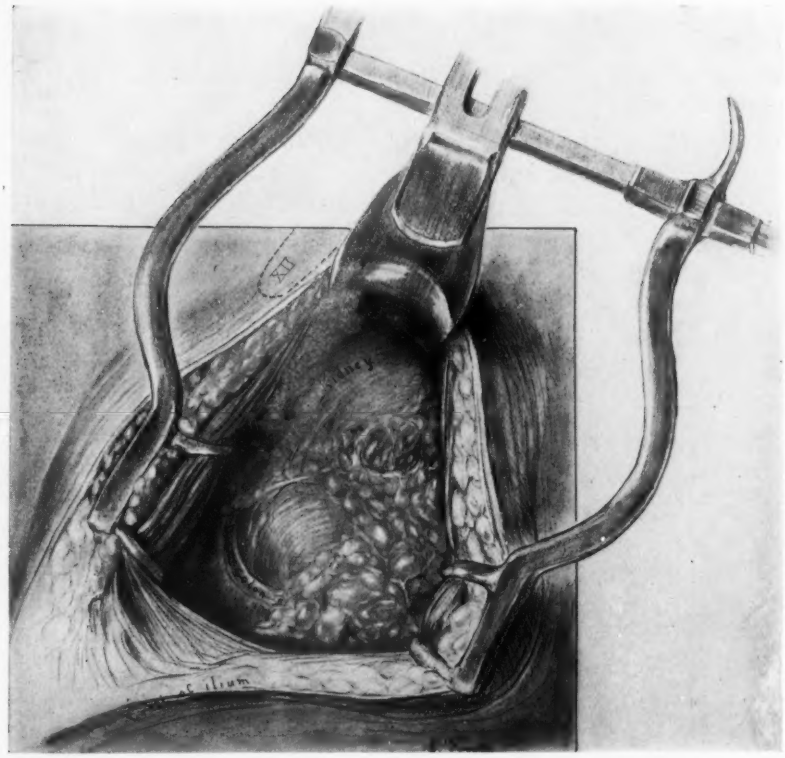


FIG. 5.—Automatic abdominal retractor separated, showing left kidney, descending colon and perirenal fat.

FIG. 6.—Muscles dropped back into position, two mattress sutures closing.

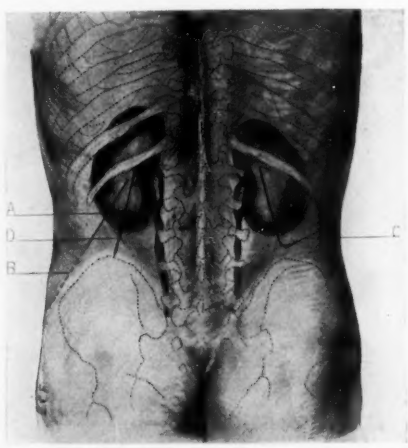


FIG. 7.—Incision for exposure of kidneys by the lumbar route. *A*, retroperitoneal exposure by oblique lumbar incision; *B*, continuation of this incision where additional room is required; *C*, retroperitoneal exposure of Koenig's angular lumbo-abdominal incision; *D*, incision in Edebohls's operation of nephropexy (Bickham).

drop the two lateral blades into the space of the lumbar fascia, forcibly and widely retract the instrument, strongly pull up the superior blade, and the perirenal fat is immediately exposed. If the stretching has been sufficiently forcible, there is an anteroposterior operative area of about 3¼ to 4 inches, which is amply wide to deal with the kidney in any way desired, whether nephropexy, nephrectomy or nephrotomy.

Among the different routes heretofore used in the foreign clinics is that of Koenig. His angular lumbo-abdominal incision (*A*, Fig. 7) unfortunately not only incises the muscles, but at times necessarily injures the twelfth dorsal, the ilio-inguinal, and the iliac branch of the iliohypogastric nerve.

Mayo's incision—which is really a continuation of *D* (Fig. 7)—is

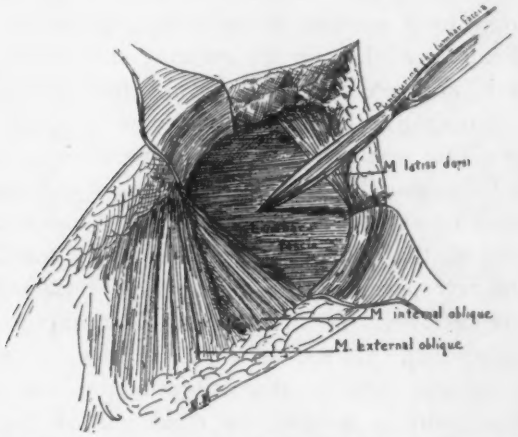


FIG. 4.—Showing latissimus dorsi, external and internal oblique retracted, and lumbar fascia being punctured.

too high, and at times necessitates removal of the twelfth rib, and is extremely liable to injure the twelfth dorsal nerve, with resultant paralysis of the abdominal group of muscles supplied by it. Judging from the number of cadavers examined by the author while investigating this point, Mayo's incision also has a tendency to open the pleural cavity, which in 65 per cent. extended below the twelfth rib, and in several instances extended 2½ centimetres below the last rib.

Kelly's incision (*A* or *B*, Fig. 7), even if one uses what he calls the lumbar angle, and which is mainly imaginary in an anatomical sense, necessitates incision of the muscles, and is liable to injure the ilio-inguinal, iliohypogastric and the twelfth dorsal nerve.

In the technic suggested by Edebohls (*D*, Fig. 7), muscle-cutting and nerve incision also occur, and it does not afford the same facilities

for dealing with ureteral complications, or the wide operative field afforded by the triangle of Petit route. By this route the author has removed even a 14-inch kidney, which had been practically destroyed by suppurative degeneration secondary to calculi, and was compelled to cut only slightly the internal and external oblique to gain additional space. The author understands how one might find it necessary to incise also the internal and external oblique, when an excessive amount of perinephritic inflammation is encountered, in order to widen the triangle of Petit route.

On the right side this route can be used for doing appendectomies, and for inspection of the gall-bladder and duodenum. The left-sided incision gives access to the tail of the pancreas, the spleen and the splenic flexure of the colon. Confronted with the necessity of doing an appendectomy on a woman, seven months pregnant, and wishing to avoid abdominal weakening afterwards, the author studied the triangle of Petit, and selected it as a route that would avoid certain liability of post-operative hernia secondary to pregnancy and child-birth. The operation was successful; post-operative results fine. The author has used the triangle of Petit route in over 30 kidney operations in various forms of renal pathology; in several cases the duodenum has been inspected, the upper fourth of which is readily brought to view, when the retroperitoneum is opened and retracted with Payr's broad-bladed retractor or the silver malleable retractor so commonly used for exposing deep cavities. The gall-bladder can be drained and even removed, as was done by the author in the case of a very old person, suffering with a gangrenous condition of the gall-bladder. When the lateral position is maintained in bed after operation, this incision gives an ideal line for drainage.

The procedure for an appendectomy by this method is as follows: Retract backward the perirenal fat until the retroperitoneum is exposed, when the ascending colon can readily be seen shining through; by lifting up this retroperitoneum with tissue forceps, it can be nicked and stretched; use the ordinary anatomical guide of the ascending colon to find, secure and operate upon the appendix; then close the peritoneum with the purse-string suture, as in the ordinary gridiron appendectomy. Operative intervention completed, one need only remove the retractors, let the parts fall together, purse-string the lumbar fascia, cease retraction of posterior and anterior muscles, when the latissimus dorsi and external and internal oblique will drop back into their respective positions requiring only a couple of sutures to close (Fig. 6). The lower angle of this triangle can be used for dam,

cigarette or tube drain, and the skin closed with Michel skin clips or horse hair, in the buttonhole method. The operation is now complete, without excessive traumatism or nerve injury, and frequently can be performed without ligating any blood supply other than that producing hemorrhage from the structure sought by the incision.

The author recommends this method and believes that it has marked advantages over the other incisions here illustrated, not only in rapidity, but in that it allows a return to normal anatomical relationship at completion of operation.

OPERATIVE TREATMENT OF TUMORS OF THE BLADDER

CLINICAL RESULTS AS OBTAINED FROM A REVIEW OF 1702 CASES OF OPERATIONS ON TUMORS OF THE BLADDER BY VARIOUS OPERATORS DURING THE LAST FIFTEEN YEARS

By James A. Gardner, M.D.
of Buffalo, N.Y.

The results of operations on tumors of the bladder during the past fifteen years, as presented in this paper, were gathered through the old method of sending blanks to a number of the leading urologists, asking for answers to certain specified questions. In this way the records of 369 cases have been procured. The records in many cases are not as complete as might be wished, owing to the lack of histories and the inability to keep track of patients, but upon the whole they are quite satisfactory.

Watson's report of 1160 cases,[1] which includes Beer's 183 cases treated by high-frequency current, Oudin, has been taken as the basis of this report. Since publishing his report and within the past five years Beer has seen 59 additional cases. Judd's report of 114 cases at the Mayo clinic is also included, which makes the total 1702.

The tumors of the bladder reported in this paper refer to those primarily in the bladder and not to malignancies which have invaded the bladder secondarily from other organs. In this series the tumors have been classified as follows: carcinomata, 178, papillomata, 175, sarcoma, 7, cysts, 4, polyp, 3, fibroma, 1, cystitis cystica, 1, total, 369. As would be expected, the great majority were carcinoma and papilloma. Tumors were present four times as frequently in the male as in the female. The average age at which they were found is about fifty years, being forty-seven and three-tenths for the papilloma and fifty-four years for the carcinoma.

Of the seven cases of sarcoma in this series two occurred at five and six and one-half years, respectively, the remaining five between the ages of thirty and seventy-three years. The results of operation in these cases were unsatisfactory, death occurring soon after operation except in one case where the patient lived four years.

The statistics regarding radium are too meager to justify drawing any conclusions, it only having been used in six cases and with little success except in one.

In operations on tumors of the bladder the surgeon has been greatly handicapped because of the inaccessibility of the tumor, it being most often found at the base of the bladder, near or involving the openings

[1] Urologic and Cutaneous Review, vol. xvii, No. 2, 1913.

of the ureters or the urethra. Because of these difficulties these tumors have been attacked mainly by suprapubic excision of the growth, either by knife or cautery. This method has been more or less successful with papilloma but not at all with malignancies. These tumors all have a tendency to recur. In papilloma 50 per cent. recur in multiple,[2]—one large and a number of small ones. Recurrences may not be recurrences but really primary growths which were so small that when the bladder was opened they were overlooked, while if treatment had been by intravesical high-frequency current they might have been recognized. The smaller number of recurrences by intravesical operation than by the open method may be thus accounted for.

TABLES OF OUR SERIES OF CASES

CARCINOMA: PARTIAL RESECTION OF BLADDER

No.	Operative mortality, 2 months	Subsequent history	Recurrences	Freedom from recurrence
	Per cent.		*Per cent.*	*Per cent.*
58	15 or 27.5	41	Under 3 years 18 or 43.9 Over 3 years 1 (4 years) 1 or 2.4	Under 3 years 15 or 36.5 Over 3 years 7 or 17
			46.3	53.5

CARCINOMA: EXCISION OF GROWTH

	Per cent.		*Per cent.*	*Per cent.*
86	12 or 14	74	Under 3 years 56 or 76.3 Over 3 years 4 or 5.5	Under 3 years 13 or 18 Over 3 years 1 or 1
			81.8	19

TABLES OF TOTAL SERIES OF CASES

CARCINOMA: PARTIAL RESECTION OF BLADDER

No.	Operative mortality, 2 months	Subsequent history	Recurrences	Freedom from recurrence
	Per cent.		*Per cent.*	*Per cent.*
224	42 or 18.7	146	Under 3 years 60 or 41 Over 3 years 4 or 2.7	Under 3 years 50 or 34 Over 3 years 32 or 22
			43.7	56

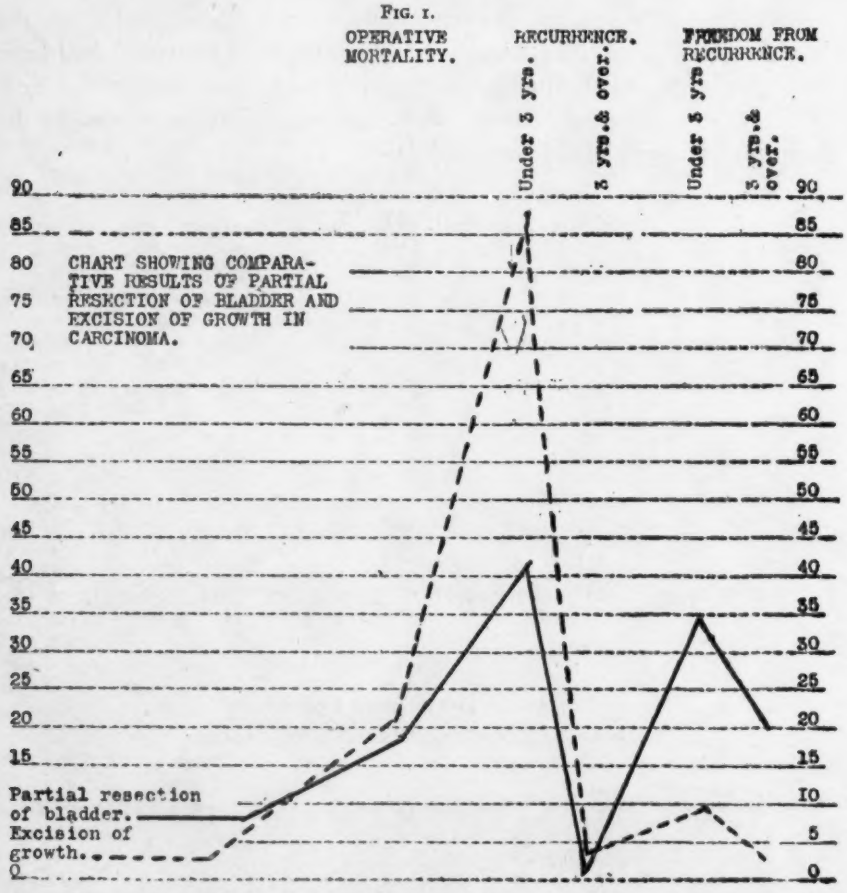
CARCINOMA: EXCISION OF GROWTH

	Per cent.		*Per cent.*	*Per cent.*
442	90 or 21	201	Under 3 years 172 or 85.5 Over 3 years 5 or 2.5	Under 3 years 19 or 9.4 Over 3 years 5 or 2.5
			88	11.9

[2] Judd: Journal Arkansas Med. Soc. Sug., 1912.

Carcinoma has been treated by various methods, the most common being suprapubic cystotomy with simple excision of the growth by scissors or curettage, removal by actual cautery, partial resection of the bladder after cystotomy, the more radical transperitoneal operation of the Mayo clinic, or Squier's subtotal cystectomy.

FIG. 1.



In the treatment of carcinoma the tables at a glance show how much superior partial resection of the bladder is to excision of the growth. The mortality has been lower, recurrence has been much less and freedom from recurrence much greater than by suprapubic excision. Included in the cases of partial resection is a series of 63 cases in which the transperitoneal method was used, with a mortality of only 10 per cent., absence of recurrence at the end of three years 33 per cent. and three patients alive five years after operation. This series is

a conclusive argument that transperitoneal resection of the bladder is the best method of partial resection.

Resection of the bladder either by transperitoneal method, as performed at the Mayo clinic, or the subtotal resection of Squier opens up the field so that the ureters, enlarged glands, and any metastases may be easily recognized before the bladder is opened, and if transplantation of the ureters is necessary, which is often the case, they are easy of access.

Included in our series are four total cystectomies and one preliminary transplanting of the ureters into the loin as the primary step. In four of these cases the ureters were transplanted into the loin and in one into the sigmoid. Three of the five died as a result of the operation, one after preliminary transplantation of the ureters into the loin, from hyperstatic pneumonia and renal insufficiency; another who had implantation into the loin died of shock, and the third patient, where the ureters were transplanted into the sigmoid, also died of shock. Unfortunately total cystectomy seems to be reserved as a last resort and the mortality from the operation in patients *in extremis* is of course very high. In cases where this operation is indicated and patients operated upon earlier, it would seem that Watson's two-step operation of first implanting the ureters into the loin will give more satisfactory results.

Squier, McCarthy, Pilcher and others have used the D'Arsonval high-frequency current upon the base of malignant tumors, after first removing the tumors with actual cautery through a suprapubic incision. Percy advocates the heat treatment for carcinoma of the bladder, using the same technic he uses for malignancies in the abdominal cavity. Few cases have been reported, however, and sufficient time has not elapsed to allow us to judge whether this method is more advantageous than excision of the growth by actual cautery, which has not proven a marked success.

Primarily the papillomata may be benign but potentially are malignant and will become so if the patient lives long enough. Pathologists report cases in which one part is benign and another part is found to be malignant. They also state that a negative report as to cancer means no more than a negative report on sputum examination for tubercle bacilli. In the face of this difficulty, which method of operation will show the least recurrence?

In the treatment of papilloma Beer's method of high-frequency current has been received as a marked step in advance. High frequency has many advantages because of its simplicity and because it obviates hospital care and confinement. The operative mortality is practically

nil. In our own series it amounts to seven-tenths per cent., which is created by one case occurring in my own practice. It seems but fair to mention this fact, inasmuch as this case was the only one in the total series of 338 cases, including those of Dr. Beer, in which death resulted from treatment. Dr. Victor Pedersen reports a case of carcinoma in which, after cystotomy, D'Arsonval current was used successfully in excision of the growth until the patient was shocked by contact between the electrode and the retractor. Patient survived operation about eight hours but never recovered from the shock which seems to have begun and was gradually increased by the electrical contact spoken of. These two cases are the only ones the writer has found where any accident has resulted from its use.

Freedom from recurrence during the short time it has been in vogue is much greater than by the open method of operation. In Beer's report of 183 cases there was much less percentage of recurrence during the first year than by the other methods of operation. Since then he has seen 59 additional cases and we have 71 which have been treated by the high-frequency method.

PAPILLOMA: EXCISION OF GROWTH

No.	Operative mortality, 2 months	Subsequent history	Recurrences	Freedom from recurrence
	Per cent.		*Per cent.*	*Per cent.*
96	6 or 6.2	87	Under 1 year 10 or 11.4	Under 1 year 15 or 17.2
			Under 2 years 6 or 6.9	Under 2 years 18 or 20.6
			Under 3 years 9 or 10.3	Under 3 years 5 or 5.7
			Under 4 years 2 or 2.3	Under 4 years 6 or 6.9
			Under 5 years 2 or 2.3	Under 5 years 3 or 3.4
			Under 7 years 2 or 2.3	Under 6 years 2 or 4.6
			35.5	Under 7 years 2 or 2.3
				Under 8 years 2 or 2.3
				Under 11 years 1 or 1
				64

PAPILLOMA: HIGH-FREQUENCY CURRENT

No.	Operative mortality	Under treatment	Treatment not effective	Subsequent history	Recurrences	Freedom from recurrence
	Per cent.				*Per cent.*	*Per cent.*
71	1 or .7	3	2	61	Under 1 year 2 or 8.2	Under 1 year 12 or 19.6
					Under 4 years 2 or 4.9	Under 2 years 21 or 34.4
					13.1	Under 3 years 15 or 24.5
						Under 4 years 3 or 4.9
						Under 5 years 2 or 3.2
						86.6

Dr. Beer after examining some of his earliest cases, which were treated four years ago, reports no signs of recurrence. Among our cases there are two of four years and over and three between three and four years without recurrence. This series shows that there is a marked difference in favor of high frequency in the absence of recurrence during the first three years than by the open method of operation. In our series there were 15 cases of carcinoma in which the spark was tried; 5 in which diagnosis was papilloma and discontinued

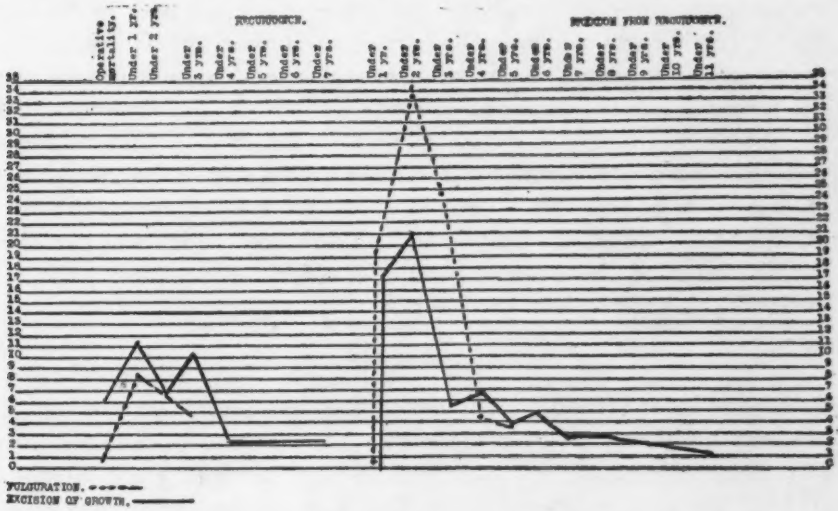


FIG. 2.—Chart showing comparative results of excision and fulguration upon papilloma.

when the diagnosis of carcinoma was made. In the other 10 it was used intentionally as a palliative but in only 3 was there any relief from the symptoms. This bears out Beer's statement that high frequency is not applicable to malignant growths in the bladder. Dr. H. Meyer has reported a series of 25 cases of papilloma treated through operating cystoscope with snare followed by electric cauterization with results that compare very favorably with fulguration, having one case ten years without recurrence.

Beer emphasizes[8] the importance of selection of cases because he states that he does not believe malignant neoplasms can be cured by intravesical high-frequency current. This conclusion has been borne out by Keyes and other urologists of large experience.

In the treatment of papilloma the question is purely one of diagnosis. Up to the present time the statistics decidedly favor treatment

[8] Journal Am. Med. Assn., No. 16, 1912.

by intravesical high-frequency current against excision, but it is early to draw a comparison between these two methods because of the short time high frequency has been in use.

In our series eight cases were diagnosed papilloma by operators which were shown by pathological examination to be carcinoma. In 13 cases, 11 of which were confirmed by microscopical examination, the growths were treated as papilloma and recurred as carcinoma. Because of the difficulty in procuring proper specimens for microscopical examination and the knowledge that these specimens may be from a benign portion while some other part of the tumor may be malignant, and because the report of the pathologist does not carry assurance that the tumor is benign, diagnosis is rendered difficult and uncertain. If we are able to diagnose positively that a growth is papilloma, high-frequency current is our best method, but until a more accurate method of diagnosing is provided,—until some blood test allied to the Wassermann or the complement fixation test is discovered which will establish the character of the growth beyond question,—there must exist an uncertainty as to the best procedure.

CONCLUSIONS

First: In treatment of carcinoma the transperitoneal method as used in the Mayo clinic or the subtotal cystectomy of Squier, with wide resection of bladder wall, offers the best method. These methods give the operator opportunity to look for enlarged glands or metastases and if necessary the ureters can be easily transplanted.

Second: Cystotomy and excision and actual cautery should only be used in terminal cases as a palliative method to relieve pain and hemorrhage.

Third: When the growth involves both ureters Watson's operation of total cystectomy with a primary operation for transplanting the ureters into the loin shows the best results.

Fourth: In the treatment of papilloma, intravesical high-frequency current during the short time it has been used has given better results than any other method, reserving the question for time and statistics to determine whether this method by reason of the difficulty in distinguishing between papilloma and carcinoma is shown to be as satisfactory as wide resection, such as is advised for carcinoma.

No.	Year	Age	Sex	Classification of tumor	Method of operation
Surgeon, L. T. Price					
1	1908	42	M	Papilloma	Suprapubic excision
2	1912	36	F	Papilloma	Four treatments, monopolar fulguration
3	1912	76	F	Diffuse papilloma and beginning carcinoma	Ten treatments, monopolar fulguration
4	1914	38	F	Diffuse papilloma	Three treatments, monopolar fulguration
5	1914	38	M	Diffuse papilloma	Five treatments, monopolar fulguration
6	1914	46	M	Papilloma	Three treatments, monopolar fulguration
Surgeon, A. Nelken					
7	1909	23	M	Papilloma	Suprapubic cystotomy and excision pedicle
8	1913	33	M	Papilloma	Suprapubic cystotomy; cauterization
9	1911	22	M	Papilloma	Cystotomy; cauterization
10	1912	70	F	Papilloma	High-frequency spark
11	1912	26	F	Papilloma	High-frequency spark
12	1911	30	M	Papilloma	Suprapubic cystotomy with excision and cauterization of base
Surgeon, J. C. Burt					
13	1911	46	M	Papilloma	Suprapubic cystotomy
14	1912	54	M	Carcinoma	Suprapubic cystotomy
15	1913	31	M	Papilloma	High-frequency spark
16	1913	33	M	Papilloma	High-frequency spark
17	1914	30	M	Papilloma	High-frequency spark
18	1914	29	M	Papilloma	High-frequency spark
Surgeon, W. S. Barnes					
19	1914	75	F	Carcinoma	High-frequency spark
Surgeon, E. R. McGuire					
20	1902	42	F	Papilloma	Suprapubic cystotomy; removal with actual cautery
21	1906	48	M	Papilloma	Suprapubic cystotomy; removal with actual cautery
22	1912	38	M	Papilloma	Intraperitoneal excision (partial)
Surgeon, E. O. Smith					
23	1911	42	M	Papilloma	Resection through suprapubic cystotomy
24	1912	38	M	Papilloma	High-frequency monopolar current; 3 treatments
25	1912	29	F	Papilloma	Monopolar high-frequency; six treatments
26	1913	43	M	Malignant epithelioma	Removal with knife and actual cautery; suprapubic cystotomy
27	1914	55	F	Papilloma	Monopolar high-frequency
Surgeon, F. Bierhoff					
28	1913	51	M	Papilloma	Suprapubic cystotomy; cauterization of base
29	1914	53	M	Papilloma	Suprapubic cystotomy; cauterization of base
30	1914	53	M	Carcinoma	Suprapubic cystotomy with curettage of growth
Surgeon, C. Bethune					
31	1914	56	F	Carcinoma	Partial resection of bladder
32	1914	58	M	Carcinoma	Suprapubic cystotomy and actual cautery
33	1914	39	M	Carcinoma	Suprapubic cystotomy; inoperable
Surgeon, M. B. McGonigal					
34	1913	33	F	Papilloma	High-frequency monopolar current
35	1914	51	M	Recurrent multiple papilloma after suprapubic excision	High-frequency monopolar current
Surgeon, T. M. Townsend					
36	1903	5	M	Lymphosarcoma	Suprapubic excision
37	1904	6½	M	Sarcoma	Suprapubic excision
Surgeon, G. H. Day					
38	1914	55	M	Papilloma	Bipolar spark
Surgeon, C. M. McKenna					
39			M	Papilloma	Suprapubic cystotomy and cautery
40			M	Papilloma	Suprapubic cystotomy and cautery
41			M	Papilloma	Suprapubic cystotomy and cautery
42			M	Papilloma	Suprapubic cystotomy and cautery
43			M	Papilloma	Suprapubic cystotomy and cautery
44			F	Carcinoma	Suprapubic cystotomy and cautery
Surgeon, B. Tenney					
45	1902	42	F	Papillary carcinoma	Suprapubic resection
46	1903	44	F	Papillary carcinoma	Infrapubic resection
47	1907	35	M	Adenocarcinoma	Suprapubic resection
48	1910	48	M	Adenocarcinoma	Total cystectomy

	Deviation of urine	Were specimens examined microscopically?	Results
.....	.....	Yes.....	Recurrence two months; lived 14 months following operation; recurrence carcinomatous. Death from septicæmia.
ation.....	.....	No.....	No recurrence; 2½ years after operation, no evidence of recurrence.
tion.....	.....	No.....	Bleeding and urinary symptoms cleaned up, after tumor reduced two-thirds in size. Examination one year afterwards, condition the same.
ation....	.....	No.....	Living one year afterwards without recurrence.
tion.....	.....	No.....	Died from other causes, cæcal-vesical fistula at time of operation on bladder. Post-mortem and pathological showed no return of papilloma.
ation....	.....	No.....	No recurrence after one year.
pedicle..	.....	Yes.....	No recurrence five years after.
n.....	.....	Yes.....	Recurrence.
.....	.....	Yes.....	No recurrence in three years.
.....	.....	No.....	Incomplete cure; patient discontinued treatment.
.....	.....	No.....	No recurrence in two years.
and cau-	.....	Yes.....	Multiple recurrence.
.....	.....	Yes, reported benign....	Recurrence since original operation, lived 30 months, died of carcinoma of the bladder.
.....	Transplantation into new location in bladder	Yes.....	Recurrence 4 months; died 9 months after operation.
.....	.....	No.....	No recurrence in one year.
.....	.....	No.....	No recurrence in one year.
.....	.....	No.....	No recurrence in one year.
.....	.....	No.....	Patient still under treatment.
.....	.....	Yes.....	Symptoms alleviated; tumor still remains in original location.
ith actual	.....	Yes.....	Recurrence; death in two years from hemorrhage.
ith actual	.....	Yes.....	No recurrence in nine years.
.....	.....	No.....	Not seen since.
tomy....	.....	Yes.....	Patient still living after three years; no recurrence.
; 3 treat-	.....	No.....	No recurrence in two years.
tments...	.....	No.....	Lost sight of patient.
ery; supra-	.....	Yes.....	Recurrence in 3 months with involvement of abdominal wall, pelvic and inguinal lymph nodes.
.....	.....	No.....	Removed with five treatments; recurrence in 5 months; 6 treatments; no recurrence in 5 months.
on of base	.....	Malignant papilloma....	14 months after operation at other points two small papillomata found.
on of base	.....	Carcinoma.....	No recurrence in 2¾ months.
ettage of	.....	Yes.....	Recurrence requiring operation one month following; radium 75 mg. applied for 18 hours following second operation.
.....	.....	Yes.....	Died of sepsis three months later.
autery....	.....	Yes.....	No recurrence six months after operation.
.....	.....	Yes.....	Died 5 weeks later from hemorrhage.
.....	.....	Yes.....	No recurrence after two years.
.....	.....	Yes.....	No recurrence in 1½ years.
.....	.....	Yes.....	Died in 32 days from pelvic cellulitis.
.....	.....	Yes.....	Died in 29 hours from cerebral embolism.
.....	.....	Yes.....	No recurrence six months after.
.....	.....	.....	No recurrence after seven years.
.....	.....	.....	No recurrence after four years.
.....	.....	.....	No recurrence in one year.
.....	.....	Carcinoma.....	Died after eight months.
.....	.....	Carcinoma.....	Died after eleven months.
.....	.....	.....	Died one year afterward.
.....	.....	Yes.....	Recurrence two years; general carcinomatosis.
.....	.....	Yes.....	Recurrence eleven months afterwards; general carcinomatosis.
.....	.....	Yes.....	Recurrence five months, extension to intestines and abdominal wall.
.....	Ureters into loin.....	Yes.....	Died in three days (shock) (?).

No.	Year	Age	Sex	Classification of tumor	Method of operation	Devi
Surgeon, H. Meyer						
49	1905	32	M	Papilloma	Operating cystoscope, snare, followed by cautery	
50	1907	30	M	Papilloma	Operating cystoscope, snare, followed by cautery	
51	1908	34	F	Papilloma	Electric cautery only	
52	1908	45	M	Large translucent cyst	Perforated in several places with large, flat cautery on operating cystoscope	
53	1908	34	M	Papilloma	Cautery through operating cystoscope	
54	1909	54	M	Papilloma	Operating cystoscope, snare, followed by cauterization	
55	1909	51	M	Papilloma	Operating cystoscope, snare, followed by cauterization	
56	1909	46	M	Papilloma	Operating cystoscope, snare, followed by cauterization	
57	1909	41	M	Papilloma	Operating cystoscope, snare, followed by cauterization	
58	1910	44	M	Papilloma	Operating cystoscope, snare, followed by cauterization	
59	1910	50	M	Carcinoma	Suprapubic cystotomy	
60	1910	50	M	Polyp	Snare only	
61	1910	37	M	Large cyst	Perforated in various places with large cautery on operating cystoscope	
62	1910	43	M	Papilloma	Operating cystoscope, snare, followed by electric cautery	
63	1911	46	M	Carcinoma	Suprapubic cystotomy and cauterization	Permane drainag
64	1911	32	F	Papilloma	Operating cystoscope, snare, followed by cautery	
65	1911	54	F	Papilloma	Operating cystoscope, snare, followed by cautery	
66	1912	28	F	Papilloma	Operating cystoscope, snare, followed by cautery	
67	1912	48	M	Papilloma	Operating cystoscope, snare, followed by cautery	
68	1912	24	M	Papilloma	Operating cystoscope, snare, followed by cautery	
69	1912	40	M	Papilloma	Operating cystoscope, snare, followed by cautery	
70	1912	54	M	Papilloma	Operating cystoscope, snare, followed by cautery	
71	1912	49	M	Papilloma	Operating cystoscope, snare, followed by cautery	
72	1913	46	M	3 cystic outgrowths at neck of bladder	Operating cystoscope with cauterization	
73	1913	35	M	A large translucent cyst through operating cystoscope; punctured with cautery		
74	1913	18	M	Papilloma	Operating cystoscope, snare, followed by cautery	
75	1913	32	M	Papilloma	Operating cystoscope, snare, followed by cautery	
76	1914	36	F	Papilloma	Operating cystoscope, snare, followed by cautery	
77	1914	52	M	Papilloma	Operating cystoscope, snare, followed by cautery	
78	1914	31	M	Papilloma	Operating cystoscope, snare, followed by cautery	
79	1915	32	M	Papilloma	Operating cystoscope, snare, followed by cautery	
Surgeon, G. S. Gordon						
80	1909	48	M	Cancer involving right ureter	Suprapubic drainage	
81	1911	60	M	Cancer involving internal sphincter	Suprapubic drainage	
82	1913	33	M	Cancer	Removal suprapubically; fulguration of stump	
83	1909	59	M	Cancer involving right ureter	Suprapubic drainage	
84	1911	55	F	Cancer involving roof of bladder and enlarged pelvic glands	Partial removal of growth	
85	1912	55	M	Cancer involving right ureteral orifice	Suprapubic cystotomy and radium in small amounts available seemed to hasten growth	
86	1911	24	M	Papilloma	Removed suprapubically	
87	1912	54	M	Carcinoma (?)	Fulguration	
Doctor, New York City						
88	1902	28	M	Multiple papilloma	Suprapubic cystotomy	
89	1906	62	M	Carcinomatous	Suprapubic cystotomy	
90	1909	32	M	Papilloma	Transperitoneal with resection of a square inch of bladder wall	
91	1910	66	M	Sarcoma	Resection one-third wall bladder	
92	1912	68	M	Carcinoma	Resection one-third wall bladder	
93	1914	30	M	Multiple papilloma	Tried high-frequency current; no benefit; have given 200 mgm. radium	
94	1914	72	M	Large carcinoma	High-frequency, no benefit; radium	
Surgeon, E. L. Keyes, Jr.						
95	1886	63	M	Globular tumor 2 inches in diameter, pedunculated, attached to base with many smaller growths	Suprapubic cystotomy; removal of tumor and curettage	
96	1891	51	M	Soft pedunculated tumor weighing 3½ ounces	Suprapubic cystotomy with removal of tumor, clamp and ligature to pedicle	
97	1900	60	M	Large villous cauliflower growth filling bladder and attached to *bas-fond*	Suprapubic cystotomy with removal of tumor	Permane fistula
98	1901	43	M	Fulminating tumor attached by broad base to left lateral wall	Suprapubic cystotomy with removal of tumor; pedicle ligated and cut; base cauterized	Permane fistula

	Deviation of urine	Were specimens examined microscopically?	Results
y	.....	No.....	No recurrence after 10 years.
y	.....	No.....	No recurrence in 1½ years.
.	.....	No.....	No reccurrence in six months; patient died of carcinoma of femur; patient had two suprapubic operations followed by recurrences.
t	.....	No.....	No recurrence in 7 years.
.	.....	No.....	No recurrence in 6 years.
-	.....	No.....	No recurrence in 2 years.
-	.....	No.....	No recurrence in 7 months.
-	.....	No.....	Recurrence in 10 months.
-	.....	No.....	No recurrence in 3 years.
-	.....	Benign.....	No recurrence in 11 months.
.	.....	Carcinoma.....	Died one year afterwards.
.	.....	No.....	No return in two years.
y	.....	No.....	No recurrence in three years.
y	.....	No.....	No recurrence in two years.
.	Permanent suprapubic drainage	Carcinoma.....	Died in one year with recurrence.
y	.....	Benign.....	No recurrence in two years.
y	.....	Benign.....	No recurrence in one year.
y	.....	No.....	No recurrence in one year.
y	.....	No.....	No recurrence in two years.
y	.....	No.....	No recurrence in two years.
y	.....	No.....	No recurrence in 15 months.
y	.....	No.....	No recurrence in two years.
y	.....	No.....	No recurrence in two years.
.	.....	No.....	No return in one year.
.	.....	No.....	No return in one year.
y	.....	No.....	No recurrence in 13 months.
y	.....	Benign.....	Seven recurrences; being treated now for recurrence.
y	.....	No.....	No recurrence in 10 months.
y	.....	No.....	No recurrence in 6 months.
y	.....	No.....	Operated December 11, 1914.
y	.....	No.....	Operated January 15, 1915.
.	.....	Yes.....	Died in 6 months, cachexia plus septicæmia.
.	.....	Yes.....	Died in 7 days; coma for 4 days preceding death.
p	.....	Yes.....	No recurrence 2 months afterward.
.	.....	Yes.....	Died in 5 months, comatose.
.	.....	Yes.....	Died in 4 months, cachexia, also metastasis.
ll h	.....	Yes.....	Died in 3 months, septic, cachectic.
.	.....	Yes.....	No recurrence one year afterward.
.	.....	No.....	One year following cystoscope showed congested and raised areas.
.	.....	No.....	Still living, returned, and all further treatment refused.
.	.....	Yes.....	Died 6 days after operation; uræmia.
ch	.....	Yes.....	No return five years afterward.
.	.....	Yes.....	No return after 4 years.
.	.....	Yes.....	Living; probably has recurrence as blood is reported again in urine.
ve	.....	No.....	Hemorrhage and pains stopped, frequency stopped; still under treatment.
.	.....	Yes.....	Entire disappearance of tumor; patient has now large sloughing area at site of base of cancer; has lost cachectic look he had before beginning treatment; patient still under treatment December 11, 1914.
d	.....	Villous papilloma.....	Return of symptoms in 1888; second operation in 1892; perineal cystotomy with removal of several pieces of tumor and curettage; later cystoscopy showed a small tuft and this was scraped away. Another cystoscopy a few days later found no tumor. No history after June 4, 1892.
r.	.....	No record.....	Well one year later; no further history.
r	Permanent suprapubic fistula	Villous carcinoma.....	Died 18 months later; had been bleeding a good deal. The growth at one time invaded the suprapubic wound.
r;	Permanent suprapubic fistula	No record.....	Cancer returned quickly and invaded suprapubic wound. Patient died 4⅗ months after operation.

No.	Year	Age	Sex	Classification of tumor	Method of operation	
Surgeon, E. L. Keyes, Jr.—*Continued*						
99	1904	66	M	Large soft villous growth.....	Suprapubic cystotomy; tumor curetted away	...
100	1908	18	M	Soft tumor to the outer side of left ureter orifice	Suprapubic cystotomy; tumor excised with adjoining mucous membrane; base sutured; no burning	...
101	1910	70	M	Large villous carcinoma with indurated base situated behind and between ureters	Suprapubic cystotomy with removal of tumor; no burning or excision of bladder wall. Partial resection of bladder at second operation	Im
102	1909	44	M	Villous tumor with small pedicle	Suprapubic cystotomy with removal of tumor and surrounding mucosa. Base cauterized	...
103	1909	61	M	Villous tumor 1 inch back of right ureter	Suprapubic cystotomy with excision and 1 inch of surrounding mucosa without suturing or burning base	...
104	1901	34	M	Pedunculated papilloma the size of a tea cup	Suprapubic cystotomy with removal of tumor	...
105	1912	..	M	Small pedunculated villous growth behind left ureter	Suprapubic cystotomy with removal of tumor by clamp and cautery; base cauterized	...
106	1913	..	M	Large papillary tumor 2 cm. back of trigone with 3 small papillary implantations in vault	Total cystectomy.....	Ea c r v l
107	1914	41	M	One pedunculated tumor 3 inches in diameter, with sloughing surface and one small papillary tumor near ureter	Suprapubic cystotomy; small tumor cut away with underlying mucosa and base burned with actual cautery. Large tumor cut away after clamping pedicle; base not burned but packed	...
108	1914	54	M	Large shaggy tumor attached to wall of bladder	Suprapubic cystotomy with removal of tumor and whole thickness of underlying bladder wall	...
109	1914	68	M	Large villous tumor in vault of bladder	Transperitoneal route with wide resection of tumor and fulguration of wound edges with Oudin current	...
110	1915	50	F	Great many papillary implantations in a line running through the ureteral orifice but not invading the trigone. One large mass near bladder neck	Suprapubic cystotomy, one tumor cut away with underlying bladder wall; the rest were burned off, except in the case of 3 large tufts which were lifted up with forceps and the adjoining mucosa burned through	...
Surgeon, H. A. Fowler						
111	1912	52	M	Papilloma.....	High-frequency current.....	...
112	...	53	M	Large pedunculated tumor.....	Transperitoneal operation; complete closure of bladder	...
113	...	37	M	Diffuse papilloma.....	Suprapubic cystotomy, tumor removed with clamp and cautery; base fulgurated. Cystoscopy 3 weeks later showed small nodule of growth had not been removed and recurred. After several applications of high-frequency current it seemed to be growing faster than we could destroy it; 2 months later suprapubic cystotomy and removal of a handful of tumor and applied glacial acetic acid to base	...
Surgeon, J. D. Barney						
114	1914	50	F	Squamous cell carcinoma.....	Suprapubic cystotomy and partial resection of bladder	Ur
115	1912	74	M	Papilloma; probably malignant..	Intravesical operation, monopolar high-frequency	...
116	1912	40	M	Squamous carcinoma.....	Cystoscopy only.....	...
117	1913	67	F	Papilloma.....	Suprapubic cystotomy and partial resection of bladder	...
118	1912	70	M	Papilloma.....	Intravesical operation, high-frequency monopolar, April and May, 1912. Suprapubic cystotomy and partial resection of bladder	...

	Deviation of urine	Were specimens examined microscopically?	Results
d away	.....	.....	Scar became indurated a few months after operation. Later a tumor the size of a base-ball was found above and attached to the symphysis pubis. Patient died one year after operation.
d with utured;	.....	Specimens showed picture resembling early stages of cystitis cystica	Well five years later.
tumor; r wall. second	Implantation in rectum..	.....	Hæmaturia recurred in 2 months. Cystoscope showed a general cystitis with aphthous ulcers and bleeding ulcer on site of old tumor; high-frequency current used; condition not improving, a laparotomy was done 4 months after original operation and indurated mass the size of a 50-cent piece found in bladder wall 4 cm. above peritoneal reflection; ureters isolated and implanted in rectum. Patient died 2 days later of general peritonitis.
f tumor uterized	.....	Papilloma with papillomatous changes in surrounding mucosa	Two months later, cystoscope showed papillary growths from scar; high-frequency current used. Seen December, 1911, had been well for a year. February, 1915, well.
and 1 t sutur-	.....	Carcinoma.....	Three months later, cystoscope showed small recurrence about upper end of scar. Burned with high-frequency current which was used on this and other new growths from time to time. At last cystoscopy in October, 1911, there was small tuft in urethra but nothing in bladder. Died of heart failure December, 1911, having had a blood pressure of 200 for several years.
f tumor	.....	.....	Hæmaturia occurred in 1904. Another suprapubic in 1910 when two large tumors were removed and many small ones were not. Hæmaturia again in 1912. Cystoscope then discovered a lumpy tumor on roof of bladder; high-frequency current used on this. Last cystoscopy December, 1914, showed velvety mucosa but no distinct evidence of tumor.
f tumor ized	.....	.....	Left hospital one month later.
.....	Each ureter led through corresponding rectus muscle to puncture wound in linea semilunaris	.....	Patient died fourth day after operation.
ut away burned ut away ned but	.....	Papillary carcinoma.....	Hæmaturia recurred in 2 months. Cystoscope showed a recurrence at site of old tumor and also 2 new growths. High-frequency current used but not successfully. January, 1915, there is infiltration of bladder wall, reaching almost to umbilicus.
f tumor bladder	.....	Papillary carcinoma.....	Patient died on tenth day from a pulmonary embolus.
ction of es with	.....	Carcinoma.....	A specimen removed from suprapubic fistula 2 months after operation was reported carcinoma; 3 months after operation there was still a pinhole fistula. Radium has been used 3 times. Cystoscope shows no tumor in bladder.
it away st were ge tufts and the	.....	Papilloma.....	Operative recovery.
.....	.....	.....	Patient had tumor removed with cold snare, June, 1911; has no recurrence in 30 months.
closure	.....	.....	No recurrence in three years.
ed with l. Cys- nodule and re- of high- growing months noval of al acetic	.....	.....	This seemed to check intravesical growth, but patient returned with evident recurrence in abdominal wall. Refused further operation; left hospital 3 months ago; probably dead.
ction of	Ureters not transplanted	Yes.....	Evident local recurrence; lived about 4 months after operation. Cause of death apparently general abdominal metastases.
igh-fre-	.....	No.....	Tumor was cauterized 3 or 4 times with almost complete removal of growth; patient then disappeared.
.....	.....	.....	Patient very sick, cachectic and emaciated; case was clearly inoperable and patient died a few weeks later.
ction of	.....	.....	Patient lost sight of, but living so far as known.
mono- rapubic bladder	.....	Yes.....	Cystotomy was done after removal of growth by high-frequency in the belief that bladder wall was infiltrated by malignant growth; no tumor cells found in specimen. Patient now alive and well; no evidence of recurrence by cystoscopic examination, 2 years.

No.	Year	Age	Sex	Classification of tumor	Method of operation	Dev
Surgeon, J. D. Barney—*Continued*						
119	1911	41	M	Papilloma	Suprapubic cystotomy and partial resection of bladder in 1909; recurrence and suprapubic cystotomy with partial resection of bladder in 1911 after several cauterizations and high-frequency	
120	1914	47	M	Cancer	Suprapubic cystotomy and partial resection of bladder	
121	1914	49	M	Cancer	Suprapubic cystotomy only for relief of hæmaturia and painful urination	
Surgeon, Horace Binney						
122	1910	33	M	Villous papilloma	Suprapubic cystotomy, excision of tumor with margin of mucous membrane; bladder closed, catheter drainage	
123	1912	46	M	Papilloma	1907, suprapubic cystotomy, curettage (Dr. J. B. Blake) 1909, recurrence, cystotomy, curettage (Dr. J. B. Blake) 1911, recurrence, cystotomy, curettage (Dr. J. B. Blake) 1912, recurrence, cauterization of multiple growths, high-frequency current begun; still under treatment	
124	1912	50	F	Papilloma	1907, excision of tumor and cauterization of base 1907, recurrence 3 months later, same operation (Dr. S. J. Mixer) 1908, recurrence, 2 small growths cauterized (Dr. L. Davis) 1912, recurrence, high-frequency, cauterization begun; continued during 1913; no recurrence during past 6 months	
125	1912	45	F	Papilloma	1911, suprapubic cystotomy, excision of tumor with margin of mucous membrane; transplantation of ureter (Dr. W. C. Quimby) 1912, recurrence, high-frequency cauterization begun	Ureters bladd outsi tion
126	1914	50	M	Papilloma, multiple	March, 1914, suprapubic cystotomy, cauterization of several papillomata; a single tumor on vertex not treated (Dr. Loder). This growth cauterized with high-frequency current during past few months	
127	1911	62	F	Villous papilloma	High-frequency current October and November, 1911	
128	1912	76	F	Villous papilloma	High-frequency current, November, 1912	
129	1912	56	F	Villous papilloma	High-frequency cauterization, October, November and December	
130	1913	30	M	Villous papilloma	High-frequency cauterization, March and April, 1913	
131	1914	51	M	Villous papilloma large	High-frequency current March to June, 1914.	
132	1911	61	M	Epithelioma	June, 1909, suprapubic cystotomy, excision of tumor, cauterization of base (Dr. A. T. Cabot). Recurrence in November, 1910, treated with high-frequency current with benefit. July, 1911, curetted and cauterization of carcinoma	
133	1911	50	M	Epithelioma	February, 1911, palliative operation for hemorrhage; suprapubic cystotomy with curetting and cauterization of infiltrating growth	
Surgeon, J. G. Keller						
134	1908	69	M	Papillary carcinoma	Bladder wall resection, suprapubic	
135	1908	21	M	Fibroma, benign	Removal of growth, no wall resection	
136	1909	55	M	Papilloma, benign at first	Removal of growth through suprapubic cystotomy; recurrence in 6 months; removed 2 small growths with cystoscope; recurrence in 8 months which was removed suprapubically. Recurrence immediately; this was fulgurated without results	
137	1909	40	M	Carcinoma of anterior wall	Suprapubic cystotomy, resection of bladder wall	
138	1909	65	M	Papilloma, benign	Suprapubic, tumor had long pedicle; part of mucous membrane of bladder removed; cutting operation	
139	1909	71	M	Malignant carcinoma	Resection of bladder wall	1 urete uppe

	Deviation of urine	Were specimens examined microscopically?	Results
of ic er h-	.....	Yes.....	No evidence of recurrence a year later; not seen since. Doubtful if cured, owing to several little growths on bladder wall, probably of same nature as parent growth.
on	.....	Yes.....	Not seen since operation.
a-	.....	.....	Resection cæcum about a year before for adenocarcinoma. Microscopic examination made. Bladder tumor discovered later and thought to be of same nature. Patient beginning to show cachexia at time of cystoscopy and evident metastases in sacroplexus. He has had one intravesical application of radium 2 months after cystotomy for relief of pain in legs; successful to date.
ith der	.....	Papillary carcinoma.....	No recurrence after 4 years; cystoscopy negative after one year.
J. Dr.	.....	Papillary carcinoma.....	Recurrence from suprapubic operation; the last operation left multiple small papillary growths throughout bladder, which have been all destroyed except one small villous mass. Last treatment November, 1914.
Dr.			
ple be-			
of	.....	.....	Last cauterization with high-frequency in March, 1914; cystoscoped in May and July; no recurrence.
ra-			
ed			
za- 13;			
nor ne; C.	Ureters transplanted in bladder short distance outside of normal position	.....	Recurrence 5 months after suprapubic operation; high-frequency cauterization destroyed this with exception of a small tuft which has been burned about every 2 months during past 2 years; patient will not come oftener on account of pain.
za-			
eri- nor his ur-	.....	.....	No recurrence; last examination and treatment with high-frequency, November, 1914.
em-	.....	Yes.....	No recurrence; cystoscopy April, 1914, 2½ years.
...	.....	.....	No recurrence; cystoscopy April 17, 1913, showed healthy bladder. No recurrence of symptoms to date,—2 years.
No-	.....	Papilloma, probably malignant	Cystoscopy October, 1914, showed normal bladder; 20 months.
and	.....	.....	Cystoscopy April, 1914, showed no sign of recurrence; no return of symptoms November, 1914, 19 months.
14.			Cystoscopy July, 1914, showed no sign of recurrence; no return of symptoms Nov., 1914, 13 months.
n of T. 910, vith iza-	.....	Carcinoma.....	Recurrence was infiltrated carcinoma. Died 10 days after last operation from intestinal obstruction.
em- ret- wth	.....	No.....	Died of exhaustion April, 1911.
...	.....	Yes.....	Died in 2 years, carcinoma of bladder and nephritis.
...	.....	Yes.....	Living in good health,—6 years.
cys- ved ence bic- was	.....	Yes.....	Patient died of carcinoma of bladder, June, 1912.
lder	.....	Yes.....	Patient living in good health,—5 years.
t of ved;	.....	Yes.....	Living in good health, no recurrence so far as I know,—5 years.
...	1 ureter transplanted into upper bladder wall	Yes.....	Died one year later, recurrence and metastases.

No.	Year	Age	Sex	Classification of tumor	Method of operation
Surgeon, F. S. Dillingham—*Continued*					
219	1906	56	F	Carcinoma	Suprapubic cystotomy, partial resection of bladder
220	1908	61	M	Multiple papilloma	High-frequency current
221	1909	55	M	Multiple papilloma	Sharp curette followed by 50 per cent. zinc chloride
222	1910	59	M	Single papilloma	High-frequency current
223	1911	57	M	Multiple papilloma	Fulguration
224	1912	58	M	Papilloma	High-frequency current
225	1912	40	M	Papilloma	High-frequency current
226	1912	30	F	Papilloma	High-frequency current
227	1914	62	F	Carcinoma	Transperitoneal cystotomy and partial resection of bladder
228	1914	60	M	Carcinoma	High-frequency current
Surgeon, Francis S. Watson					
229	1899	36	M	Multiple carcinoma	Suprapubic excision by galvanocautery
230	1901	38	M	Multiple carcinoma	Suprapubic excision by galvanocautery
231	1900	42	M	Broad based sessile benign papilloma size of English walnut	Partial resection of bladder, extraperitoneal of an area above the right ureter including a broad margin around base of tumor the size of a dollar
232	1904	28	M	Benign papilloma	Galvanocautery, suprapubic excision
233	1906	40	M	Broadly sessile dense based tumor, carcinoma	Partial extraperitoneal resection, but not thoroughly done
234	1909	31	M	Benign papilloma	Galvanocautery, suprapubic excision
235	1909	54	M	Benign papilloma	Suprapubic excision and suture of resulting wound
236	1910	41	M	Carcinoma on left of trigone, ureter involved	Partial resection, extraperitoneal, suprapubic resection
237	1911	34	M	Multiple benign papilloma (?)	Suprapubic galvanocautery excision
238	1898	34	M	Multiple papilloma, probably benign	Suprapubic excision and curetting first operation. Excision with cold instrument; galvanocautery at third
239	1899	37	F	Benign papilloma	Galvanocautery excision; suprapubic
240	1902	53	M	Multiple carcinoma	Galvanocautery excision
Surgeon, J. A. Gardner					
241	1907	49	M	Papilloma	Suprapubic cystotomy; removed by actual cautery
242	1909	67	M	Papilloma	Monopolar current 1911 after cystotomy and cauterized 1909
243	1910	45	M	Papilloma	Suprapubic cystotomy and actual cautery
244	1911	73	F	Papilloma	Monopolar current
245	1911	31	M	Papilloma	Monopolar current
246	1911	55	M	Papilloma	Monopolar current
247	1912	60	M	Carcinoma	Bipolar current
248	1912	53	M	Carcinoma	Suprapubic cystotomy; actual cautery followed by bipolar fulguration
249	1913	62	M	Papilloma	Suprapubic cystotomy; actual cautery followed by fulguration
250	1913	65	M	Papilloma	Fulguration, bipolar current
251	1913	53	M	Carcinoma	Suprapubic cystotomy; actual cautery, bipolar current to stump
252	1913	55	F	Papilloma	Fulguration, bipolar current
253	1913	61	F	Papilloma	Fulguration, bipolar current
254	1913	52	M	Papilloma (?)	Fulguration, bipolar current
255	1913	80	M	Papilloma in diverticulum	Suprapubic cystotomy; excision of diverticulum and papilloma with actual cautery
256	1913	60	M	Papilloma	First tried fulguration, bipolar current, then suprapubic cystotomy, excision by actual cautery

	Deviation of urine	Were specimens examined microscopically?	Results
tion of	.....	Yes.....	Died in 3 weeks; bladder growth the size of a quarter, involved whole bladder wall. Lymphatic walls involved as high as diaphragm; acute uræmia.
.....	.....	No.....	Committed suicide one year later.
nt. zinc	.....	Yes.....	Six months later return of 1 patch ¼ inch in diameter; would not return for fulguration because of no symptoms; still alive; now has multiple papilloma.
.....	.....	No.....	Last examined 1912; no recurrence.
.....	.....	No.....	Good progress, each treatment followed by relief of hemorrhage and ability to void. Would not return regularly. Growths multiplied. Suprapubic cystotomy proved carcinoma; treatment discontinued.
.....	.....	No.....	Last examination 3 months ago; O. K.
.....	.....	No.....	Examination 1 month ago, O. K.
.....	.....	No.....	Examination 5 months ago, O. K.
l resec-	.....	Yes.....	Alive and well.
.....	.....	Yes.....	Done for relief of hemorrhage and obstructing tumors; terminal case.
y.....	.....	Yes.....	Recurrence and death 9 months later. Cause of death cachexia of malignant disease.
y.....	.....	Yes.....	Rapid recurrence and death from exhaustion and metastasis in liver and lungs 3 months after operation.
ritoneal ncluding mor the	.....	Yes.....	Patient reported 5 years later and had up to that time been free from recurrence and well.
.....	.....	Yes.....	Recurrence in 1 year, not *in situ;* 2nd operation, no recurrence up to 18 months later; then lost sight of patient.
ut not	.....	Yes.....	Patient died 6 months later, of local recurrence from metastasis.
.....	.....	Yes.....	Was free from symptoms for 2 years; then hæmaturia recurred; reported by letter; did not see patient again and do not know results.
esulting	.....	Yes.....	No recurrence up to end of third year.
rapubic	Ureter in bladder.....	Yes.....	Patient had recurrence in 16 months and died in consequence of it.
.....	.....	No.....	Patient had no recurrence up to 18 months following; has not reported since.
t opera- nt; gal-	.....	Yes.....	Patient had 18 months freedom from recurrence after first operation, two years after second, and less than one year after third. Lost sight of after third operation. The neoplasms at the third recurrence had the clinical evidence of being malignant, in two instances at any rate, but no microscopical examination was made.
		No.....	
		No.....	
.....	.....	Yes.....	There was no recurrence during 2 years; patient died at that time of renal disease.
.....	.....	Yes.....	Recurrence and metastasis within 2 months and death due to these conditions in four months.
actual	.....	No.....	No recurrence; last saw him October, 1914; 7 years afterward.
my and	.....	No.....	Examined February 15, 1915, 4 years after; no recurrence.
tery....	.....	.....	Five years later recurrence, fulguration, monopolar current. After fulguration no recurrence in 2 years. Last seen 1913.
.....	.....	No.....	Reported O. K. 1913,—2 years after.
.....	.....	No.....	Lost track of 6 months afterward.
.....	.....	No.....	Reported O. K. December, 1914; 3½ years after.
.....	.....	Yes.....	By Squier. Could not stop bleeding; went to Dr. Squier, who did suprapubic cystotomy followed by bipolar current. Patient died 30 days afterwards from embolus. Autopsy showed no remnant of tumor in bladder wall.
ery fol-	.....	Yes.....	Patient died of recurrence in 3 months.
ery fol-	.....	No.....	O. K. December, 1914; 21 months after.
.....	.....	No.....	O. K. December, 1914; 19 months after.
, bipolar	.....	No.....	Died 3 months afterwards, metastasis.
.....	.....	No.....	O. K. December, 1914; 18 months after.
.....	.....	No.....	O. K. December 7, 1914; 18 months after.
.....	.....	No.....	Hemorrhage was controlled; patient gained in weight; was under treatment 6 months; lived out of town; following last treatment December 3, 1913, had hemorrhage which local physician could not control. Died in 48 hours.
iverticu- tery	.....	No.....	O. K. September, 1914; 1 year after.
nt, then y actual	.....	No.....	Died 9 months after from recurrence, carcinoma.

No.	Year	Age	Sex	Classification of tumor	Method of operation	I
Surgeon, J. A. Gardner—*Continued*						
257	1914 (Feb.)	67	M	Carcinoma	Suprapubic cystotomy, actual cautery and bipolar current	.....
258	1914 (June)	59	M	Papilloma	Bipolar high-frequency	.....
259	1914 (July)	43	M	Papilloma	Bipolar high-frequency	.....
260	1914 (Aug.)	57	M	Carcinoma	Suprapubic cystotomy; inoperable	.....
261	1914 (Aug.)	59	M	Papilloma	Bipolar current	.....
262	1914 (Sept.)	53	M	Papilloma	Bipolar current	.....
263	1912	34	M	Papilloma	Bipolar current	.....
Surgeon, G. S. Whiteside						
264	1913	65	F	Small, hard carcinoma	Suprapubic resection of most of the bladder	.....
265	1902	60	M	Villous papilloma	Suprapubic cystotomy and actual cautery	.....
266	1900	52	M	Diffuse infiltrating carcinoma	Suprapubic cystotomy, cystectomy	Uret mo
267	1900	58	M	Carcinoma	Suprapubic cystotomy and actual cautery	.....
268	1913	27	M	Probably non-malignant papilloma	Snare, operating cystoscope	.....
269	1914	29	M	Probably non-malignant papilloma	Suprapubic cystotomy; removal by actual cautery	.....
270	1906	60	M	Carcinoma	Complete cystectomy	Uret mu
271	1904	65	M	Carcinoma	Refused operation until 1 year later than first seen; then suprapubic cystotomy for drainage	
272	1905	62	F	Sarcoma	Piece removed by operating cystoscope for examination, but case was inoperable	.....
273	1914	43	F	Carcinoma	Operation refused in October when growth was small. Vaginal cystotomy for drainage in January, 1915, when case was inoperable	.....
274	1913	81	M	Polypoid round tumor size of filbert nut	Suprapubic cystotomy, snare and actual cautery	.....
Surgeon, F. W. Robbins						
275	1901	67	M	Papilloma	Suprapubic cystotomy, excision of tumor and cauterized base	.....
276	1912	61	M	Papilloma	High-frequency	.....
Surgeon, Victor Petersen						
277	1912	53	M	Carcinoma of the bladder	High-frequency current of Oudin; tried about once a week for 2 months; 8 applications without benefit except clearing the surface of the ulcer. Then excision was decided on with D'Arsonval current; highly successful until patient was shocked by contact between electrode and a retractor	.....
278	1913	53	M	Carcinoma of the bladder	Preliminary treatment for cleansing the bladder was done for 2 weeks, when operation was suggested; patient to general surgeon who was quite a faddist on radium and by him persuaded to permit the insertion of a tube of radium	.....
279	1913	40	M	Benign papilloma of the bladder.	High frequency current of Oudin, seven applications	.....
280	1913	47	M	Benign papilloma of the bladder.	Oudin current	.....
281	1913	50	M	Papillary carcinoma of the bladder	Oudin current with immediate promising results; abdominal section later for resection of bladder	.....
282	1913	55	M	Early carcinoma	Oudin current; abandoned on account of pain; Squier's operation, with transplantation of right ureter	.....
Surgeon, J. Bentley Squier						
283	1904	57	M	Carcinoma	Suprapubic cystotomy, incomplete removal; actual cautery to base	.....
284	1906	55	M	Carcinoma	Suprapubic removal, cautery of base	.....
285	1906	60	M	Carcinoma	Suprapubic removal, cautery of base of tumor	.....
286	1910	54	M	Carcinoma	Suprapubic removal with resection of bladder walls	.....
287	1909	80	M	Carcinoma	Suprapubic removal with resection of bladder wall	.....
288	1910	81	M	Carcinoma	Suprapubic removal of recurrence. (Same as preceding)	.....
289	1911	58	M	Extensive carcinoma	Suprapubic removal and cautery; resection impossible	.....
290	1911	63	F	Papillary papilloma	Bipolar fulguration	.....
291	1912	72	M	Carcinoma of bladder neck	Suprapubic removal of intravesical projection and cautery to base	.....

	Deviation of urine	Were specimens examined microscopically?	Results
y and	.....	No.....	Died 5 months after; recurrence of growth.
.....	.....	.....	O. K. December 15, 1914.
.....	.....	.....	Under treatment at present time. I think this is carcinoma, but patient refuses any operation (Feb. 3, 1915).
.....	.....	Yes.....	Died 2 months after of cachexia.
.....	.....	No.....	Lost sight of after 4 treatments.
.....	.....	No.....	Under treatment.
.....	.....	No.....	Examination February 8, 1915; recurrence over old site twice as large as before; noticed bleeding three months ago.
lder..	.....	Yes.....	Death in 6 weeks from urinary infiltration of the abdom nal wall and resulting sepsis.
ery...	.....	Yes.....	Death one week after operation.
.....	Ureters implanted in sigmoid	Yes.....	Death in 10 days; complete relief from pain.
ery...	.....	Yes.....	Recurrence 1¼ years; severe hemorrhage; death.
.....	.....	Yes.....	Patient lost sight of; last heard of 1 year after removal; O. K.
actual	.....	No.....	Up to present time patient perfectly well.
.....	Ureters out through back muscles	Yes.....	Died 7 months after operation; no recurrence. Immediate cause of death unknown.
n first inage		No.....	Died after drainage operation; shock and exhaustion.
pe for	.....	Round cell sarcoma.....	Death from asthenia and hemorrhage about two months after first seen.
h was age in able..	.....	.....	Died of asthenia two weeks after operation. Both kidneys, bladder, uterus, sigmoid and liver diseased; growth primarily in bladder.
actual	.....	Considered not malignant	No recurrence; apparently complete cure; still living and well.
or and	.....	Yes.....	First bleeding two months after operation. Lived 3 years. Cause of death, urinary septicæmia.
.....	.....	No.....	Growth was never entirely destroyed, probably due largely to faulty technic; examined in October, 1914; believe that it is now malignant.
about ations urface led on cessful ct be-	.....	.....	Patient survived operation about 8 hours, but never recovered from shock, which seems to have begun and greatly increased by the electrical contact spoken of.
bladration rgeon nd by n of a	.....	.....	I heard from family physician who brought him to me that the man died a miserable death with chronic sinus, four months later.
appli-	.....	.....	Examination December 31, 1914, 14 months after finish of treatment, no recurrence.
.....	.....	.....	Examination December, 1914, 18 months after; no recurrence.
ng re- ection	.....	.....	Died 8 months after of general abdominal carcinoma.
f pain; ion of	.....	.....	Immediate results of operation most satisfactory and technic easy to carry out. Patient developed bronchopneumonia; died 22 days after.
noval;	.....	Yes.....	Recurrence 3 months; death from cachexia; incomplete operation.
.....	.....	Yes.....	Recurrence 5 months; death from cachexia; incomplete operation.
tumor	.....	Yes.....	Recurrence 3 months, death from cachexia; incomplete operation.
ladder	.....	Yes.....	No recurrence; patient living February, 1915.
ladder	.....	Yes.....	Recurrence; second operation one year after first. (See following case.)
me as	.....	Yes.....	Recurrence; lived 4 years after second operation with permanent suprapubic fistula, in comfort and at business. Died at 85 of vesical hemorrhage.
ection	.....	Yes.....	Recurrence; died in 4 months of pneumonia. Growth too extensive to attempt resection.
.....	.....	Yes.....	Recurrence in 4 months; last heard of one year after operation.
ection	.....	Yes.....	Incomplete removal; obstruction to urination removed by operation. Died from intestinal metastasis. Bladder comfortable to death. Lived one year.

No.	Year	Age	Sex	Classification of tumor	Method of operation	
Surgeon, J. Bentley Squier—*Continued*						
292	1912	63	M	Carcinoma	Suprapubic removal and resection of bladder wall	..
293	1912	50	M	Adenocarcinoma, extensive	Suprapubic cystotomy and bipolar fulguration	..
294	1912	52	M	Carcinoma	Sub-total cystectomy	T
295	1912	60	M	Extensive carcinoma	Suprapubic cystotomy and bipolar fulguration to base of tumor	..
296	1912	45	M	Large tumor projecting into bladder from thick pedicle; carcinoma	Sub-total cystectomy	..
297	1913	58	M	Carcinoma	Sub-total cystectomy	..
298	1913	49	M	Carcinoma	Sub-total cystectomy	T
299	1913	50	M	Carcinoma	Sub-total cystectomy	T
300	1913	30	M	Sarcoma	Resection incomplete	..
301	1913	56	M	Carcinoma	Sub-total cystectomy	..
302	1913	55	M	Carcinoma	Sub-total cystectomy	..
303	1913	70	M	Carcinoma	Sub-total cystectomy	T
304	1913	72	M	Carcinoma	Sub-total cystectomy	T
305	1913	60	M	Carcinoma	Sub-total cystectomy	T
306	1914	49	M	Carcinoma	Sub-total cystectomy	..
307	1914	43	M	Carcinoma	Sub-total cystectomy	..
308	1914	60	F	Carcinoma	Incomplete removal; suprapubic cystotomy; growth too extensive	..
309	1914	45	F	Carcinoma	Sub-total cystectomy	..
310	1914	35	M	Carcinoma	Sub-total cystectomy	U
311	1914	57	M	Carcinoma	Sub-total cystectomy	..
312	1914	61	M	Carcinoma	Sub-total cystectomy	..
313	1914	53	M	Carcinoma	Sub-total cystectomy	..
314	1914	40	M	Carcinoma	Sub-total cystectomy	..
315	1914	50	M	Carcinoma	Sub-total cystectomy	..
316	1914	63	M	Carcinoma	Suprapubic removal of recurrence; incomplete operation	..
317	1914	57	M	Carcinoma	Sub-total cystectomy	U
Surgeon, Arthur L. Chute						
318	1907	58	F	Sessile mass infiltrating left side of bladder and bladder outlet	Suprapubic cystotomy with curettage and actual cautery	..
319	1907	60	M	Infiltrating growth at outlet, may have been an extension from prostate	Permanent suprapubic drainage	..
320	1908	52	M	Massive papillomative growth	Partial resection by transperitoneal route	..
321	1909	68	M	Large infiltrating mass in region of right ureter	Transperitoneal resection of bladder	R
322	1909	40	M	Multiple papilloma	Suprapubic incision; larger growths excised; smaller curetted or wiped off	..
323	1909	47	F	Nearly whole bladder infiltrated	Curettage and drainage	..
324	1909	52	M	Papillary growth involving whole bladder	Scraped out a large amount and drained	..
325	1909	73	M	Sarcoma right lateral wall of bladder	Transverse suprapubic cystotomy; resection of a considerable portion of bladder wall	..
326	1910	64	M	Sessile growth about bladder outlet	Suprapubic curettage and cauterization with actual cautery	..
327	1911	65	M	Second operation on above case	Suprapubic drainage	..
328	1910	58	F	Sessile growth involving base and bladder outlet	Suprapubic incision, curettage and actual cautery	..
329	1911	46	M	Small growth of left lateral wall of bladder	Widely excised by transperitoneal incision	..
330	1911	39	M	Infiltrating mass of upper posterior part of bladder	Suprapubic excision of mass	..
331	1911	84	F	Large sessile growth of right lateral wall very near bladder outlet	Growth cut away with scissors rather than excised; surface treated with actual cautery	..

	Deviation of urine	Were specimens examined microscopically?	Results
f bladder	.....	Yes	Operation of extensive resection; death from shock in 24 hours.
fulgura-	.....	Yes	No recurrence; died from pulmonary embolus 4 weeks after operation. At autopsy bladder removed; no evidence of carcinoma found.
.....	Transplantation of ureters	Yes	Died of post-operating shock.
fulgura-	.....	Yes	This patient had diabetes; death from diabetic-coma four days after operation.
.....	.....	Yes	No recurrence; patient living 18 months after operation, Last examined 1913.
.....	.....	Yes	No recurrence; living 14 months after operation.
.....	Transplantation of ureters	Yes	Recurrence 7 months; death from vesical hemorrhage.
.....	Transplantation of ureters	Yes	Recurrence 14 months; intestinal metastasis; bladder gave no symptoms.
.....	.....	Yes	Recurrence; death from embolus.
.....	.....	Yes	No recurrence; patient alive and without symptoms 2 years after operation. Examined February, 1915.
.....	.....	Yes	No recurrence; patient alive 26 months after operation. Last examination 1915.
.....	Transplantation of ureters	Yes	No recurrence; patient alive 7 months after operation. Examination February, 1915.
.....	Transplantation of ureters	Yes	Recurrence 3 months after operation; incomplete operation, appreciated at time of operation.
.....	Transplantation of ureters	Yes	No recurrence; died of pneumonia two weeks after operation.
.....	.....	Yes	No recurrence; living 13 months after operation. Last examination February, 1915.
.....	.....	Yes	No recurrence; living 15 months after operation. Last examination February, 1915.
stotomy;	.....	Yes	Died 8 months after operation from extension of growth.
.....	.....	Yes	No recurrence; died in 6 weeks of intestinal metastasis; present at time of operation.
.....	Urethral transplantation.	Yes	No recurrence; alive one year after operation, free from symptoms; last examined February, 1915.
.....	.....	Yes	Died of pneumonia 4 weeks after operation. No autopsy.
.....	.....	Yes	Died of intestinal obstruction from giving way of closure sutures of abdominal wall; gut forced out of wound and resultant strangulation; bladder removed at autopsy, serial sectioned and no cancer could be demonstrated.
.....	.....	Yes	No recurrence or symptoms 10 months after operation. Last examined January, 1915.
.....	.....	Yes	Alive and no recurrence 12 months after operation. Last examination February, 1915.
.....	.....	Yes	Alive and no recurrence 12 months after operation. Last examination February, 1915.
complete	.....	Yes	Died 18 months after primary operation; recurrence 6 months after suprapubic and cautery operation by another surgeon; secondary operation for relief of prevesical separation and bladder drainage.
.....	Urethral transplantation	Yes	No recurrence 6 months after operation. Last examined February, 1915.
age and	.....	No	Patient died in 3 weeks. No autopsy.
.....	.....	Carcinoma	Patient died of recurrence within a year.
oute....	.....	No	Patient died on fifth day; probably of peritonitis.
.....	Reimplantation of right ureter	Carcinoma	Died on fourth day; uræmia (?), peritonitis (?). No autopsy.
excised;	.....	Papillary carcinoma	Have recently heard of his death a few days ago of recurrence; for several years without symptoms.
.....	.....	No	Died 10 months later; had large mass on left side of neck; presumably metastasis.
ied.....	.....	No	Was relieved for a time. Died of recurrence in about six months.
resection f wall ion with	.....	Sarcoma	Patient made a fair recovery and got about for a time, but died of recurrence within a relatively few months.
	.....	No	Had relief for a time; 13 months later I opened his bladder for drainage. The whole bladder was involved; died two weeks later of exhaustion.
.....	.....	No	Died two weeks later; see above case.
l actual	.....	No	Died seven days later; probably renal insufficiency. No autopsy.
ision...	.....	Cancer of bladder	Examined 3 years later, no sign of recurrence.
.....	.....	Mucous cancer	Died 13 months later. Autopsy showed bladder size of a peach, great masses of retroperitoneal, pelvic and mesenteric metastasis. Pus in left kidney.
ier than cautery	.....	Medullary cancer	Incision healed but patient never comfortable. Died about 2 months after operation. No autopsy.

No.	Year	Age	Sex	Classification of Tumor	Method of Operation	
Surgeon, Arthur L. Chute—*Continued*						
332	1912	55	M	Papillomatous growth about bladder outlet	Growth partly cut away, partly removed with curette. Area treated with actual cautery	....
333	1912	49	M	Papilloma of left lower part of bladder	Suprapubic excision of area about base.....	....
334	1912	73	M	Two small infiltrating areas, one near bladder outlet, one on right lateral wall	These were found during a suprapubic prostatectomy; both areas were excised with a fair margin	....
335	1912	50	M	Papilloma.....	Suprapubic removal with cautery after clamping base	....
336	1912	39	M	Papilloma outside and behind left ureter	Suprapubic cystotomy; pedicle clamped and cut away with cautery	....
337	1912	52	M	Large papillomatous masses, one weighing 2½ ounces involving all lower part of bladder	Suprapubic excision of some, excision with cautery of others	....
338	1914	54	M	Small mass on bladder floor size of 50-cent piece covered with small papilloma	Transperitoneal resection of portion of the bladder	....
339	1913	43	M	Small papilloma near bladder outlet on left	Suprapubic incision; excision with cautery...	....
340	1913	67	M	Two papillomatous masses near bladder base	Suprapubic resection of bladder.....	....
341	1913	54	M	Small papilloma on floor of bladder	Suprapubic excision.....	....
342	1913	64	M	Infiltrating growth on right involving outlet	Suprapubic curettage and cautery.....	....
343	1913	52	F	Tumor size of walnut near left ureter	Suprapubic excision.....	....
344	1913	67	F	Tumor size of silver dollar about right ureter	Suprapubic excision of mass as large as a large plum	R e of
345	1913	56	M	Infiltrating growth left wall of bladder near outlet	Suprapubic curettage and cauterization.....	....
346	1913	53	F	Large infiltrating mass in posterior wall of bladder, low down	Large part of bladder excised with growth...	....
347	1913	48	M	Small strawberry polyp near left ureteric orifice	A few applications of high-frequency current caused its disappearance	....
348	1914	51	M	Small suspicious looking mass on right lateral wall of bladder, low down	Mass excised with fair area of healthy tissue	....
349	1914	57	F	Indurated mass on left lateral wall size of silver dollar	Suprapubic cystotomy and mass cut away, parts curetted; actual cautery used	....
350	1914	66	M	Infiltrating mass about size of a walnut just above bladder outlet. Five per cent. sugar	Suprapubic removal of the mass with a small margin of side of urethra	....
351	1914	68	F	Bladder filled with papillomatous growth	Suprapubic removal of tumor with its base...	....
352	1914	50	M	Papillomatous mass left ureter orifice	After several applications of high-frequency current mass seemed to be increasing; operation advised	....
353	1915	62	M	Papillomatous mass on base, 2 small ones on summit of bladder	Is receiving treatments with high-frequency current with apparent benefit	....
354	1915	59	F	Infiltrating growth involving base and posterior portion of bladder	Both ureters transplanted into loins, preliminary to a total cystectomy	Bot in
Surgeon, A. Hyman						
355	1912	58	M	Papillary carcinoma.....	Suprapubic cystotomy with removal by actual cautery	....
356	1914	48	M	Papillary carcinoma.....	High-frequency; unipolar.....	....
357	1913	59	M	Benign papilloma.....	Suprapubic cystotomy; removal by actual cautery through pedicle	....
358	1911	52	M	Benign papilloma.....	High-frequency; unipolar.....	....
359	1911	50	M	Benign papilloma.....	High-frequency; unipolar.....	....
360	1912	62	M	Benign papilloma.....	High-frequency; unipolar.....	....
361	1912	76	M	Benign papilloma.....	High-frequency; unipolar.....	....
362	1912	69	M	Benign papilloma.....	High-frequency; unipolar.....	....
363	1913	46	M	Benign papilloma.....	High-frequency; unipolar.....	....
364	1913	40	M	Benign papilloma.....	High-frequency; unipolar.....	....
365	1913	45	F	Benign papilloma.....	High-frequency; unipolar.....	....
366	1913	40	M	Benign papilloma.....	High-frequency; unipolar.....	....
367	1913	50	M	Benign papilloma.....	High-frequency; unipolar.....	....
368	1913	42	M	Benign papilloma.....	High-frequency; unipolar.....	....
369	1913	52	M	Benign papilloma.....	High-frequency; unipolar.....	....

	Deviation of urine	Were specimens examined microscopically?	Results
d with utery	.....	Papilloma suggesting malignancy	Cystoscopy two years later, bladder showed some little pads around the bladder outlet. Reported a few months ago that he was free from trouble.
.....	.....	.....	Reported as well two years after operation.
prosta- a fair	.....	Carcinoma.....	Patient was fairly comfortable for a year; since then a good deal of distress. Died February 17, 1915.
clamp-	.....	Papilloma.....	Died of embolism on fourth day after operation.
ed and	.....	No.....	Was well a year or more after operation.
with	.....	Papilloma.....	Was comfortable for a year; then blood. Cystoscope showed a recurrence. High-frequency did not control.
of the	.....	Papilloma.....	Died of uræmia or gastro-mesenteric ileus, a few days after operation. Second operation on above case.
ery...	.....	No.....	Well a year later.
.....	.....	Papilloma.....	No symptoms December 26, 1914.
.....	.....	Papilloma.....	Reported as well some months ater.
.....	.....	No.....	Was living nearly a year later. Not heard from since.
.....	.....	Papilloma.....	Patient showed no sign of recurrence over a year later.
a large	Reimplantation of ureters	No.....	One year later was comfortable and cystoscopy showed no signs of recurrence at that time.
.....	.....	No.....	Died 11 months later. Autopsy showed double pyonephrosis. Great glandular masses in pelvis behind the peritoneum.
wth...	.....	No.....	Patient died 48 hours after operation supposedly of shock and renal insufficiency. No autopsy.
current	.....	No.....	Patient reports himself well a year later.
tissue	.....	Carcinoma.....	Eight months later cystoscopy showed no signs of recurrence.
away,	.....	Carcinoma.....	Patient recovered enough to leave hospital, but died about two months after operation. No autopsy.
small	.....	Carcinoma.....	There is no sign of recurrence cystoscopically, but patient is going down hill and I believe cannot live long. (Died January 29, 1915). Is sugar free.
base...	.....	No.....	Patient's condition was reported as satisfactory a few weeks ago. Has not been cystoscoped.
quency opera-	.....	No.....	No report in seven weeks.
quency	.....	No.....	Patient first operated on suprapubically five years ago for a large papilloma. Recurrence two years ago treated with high-frequency. This is second recurrence.
relimi-	Both ureters transplanted into loins	No.....	Operation 10 days ago; patient since died, had a hypostatic pneumonia. I think he also had more or less renal insufficiency.
actual	.....	Yes.....	Died 11 months after; cachexia.
.....	.....	Yes; reported benign....	Died 3 months later; cachexia, spinal cord metastasis.
actual	.....	Yes.....	No recurrence; living 1 year, 10 months after. Cystoscoped last April, 1914.
.....	.....	Yes.....	No recurrence; living. Last cystoscopy May, 1914, 3 years after treatment.
.....	.....	Yes.....	No recurrence; living. Last cystoscopy December, 1914, 3 years after treatment.
.....	.....	No.....	No recurrence; living. Last cystoscopy February, 1914, 2 years after treatment.
.....	.....	No.....	No recurrence; living. Last cystoscopy December, 1912, 9 months after treatment.
.....	.....	Yes.....	Well till October, 1914, then recurrence of hæmaturia. Operated by another physician and a carcinoma found in another part of bladder.
.....	.....	Yes.....	Recurrence 6 months later; living. Last cystoscopy August, 1914, 19 months later.
.....	.....	Yes.....	No recurrence; living. Last cystoscopy August, 1914, one year later.
.....	.....	Yes.....	No recurrence; living. Last cystoscopy August, 1914, 15 months later.
.....	.....	No.....	No recurrence; living. Last cystoscopy May, 1914, one year later.
.....	.....	Yes.....	No recurrence; living. Last cystoscopy June, 1914, 13 months later.
.....	.....	No.....	No recurrence; living. Last cystoscopy March, 1914, 7 months later.
.....	.....	No.....	No recurrence; living. Last cystoscopy July, 1914, 11 months later.

SUPRAPUBIC PROSTATECTOMY IN TWO STAGES*

By Joseph Wiener, M.D.
of New York
Associate Surgeon, Mount Sinai Hospital

The removal of the hypertrophied prostate in two stages, through a suprapubic incision, has become a well recognized procedure by an ever-increasing number of surgeons in this country, and is beginning to be introduced into the clinics abroad. Though much has been written on this subject in the past ten years, a complete historical paper has never been attempted. As the writer was among the very first to practise and to advocate the operation, it has seemed to him that a thorough review of the work done along these lines would be of value not only historically, but would also tend to still further increase the popularity of the procedure. No doubt due to the absence of such a paper, numerous articles have appeared, both here and abroad, in which the operation as we practised it ten years ago is very accurately described as a new procedure. This has happened so frequently and so repeatedly, and even so recently, that no further apology for this paper need be made.

Suprapubic prostatectomy in one stage dates back to 1886 and 1887, when Belfield, of Chicago, and McGill, of Leeds, published their first cases. McGill removed obstructing portions of the prostate and gradually increased the amount removed until he did a complete prostatectomy. Belfield added a perineal incision for drainage. Fuller, of New York, and Freyer, of London, deserve credit for developing and carrying out successfully the present operation for enucleation of the prostate through a suprapubic incision at one sitting. The great epochs in the development of suprapubic prostatectomy are: (1) McGill and Belfield's original work in 1886 and 1887. (2) The abolition of vasectomy, castration and the Bottini operation. (3) The introduction of urinary antiseptics. (4) The two-stage operation.

Historical Considerations.—The writer's first two-stage prostatectomy was done in September, 1903, and was reported in a paper on "Suprapubic Prostatectomy under Nitrous Oxid Anæsthesia," published in the *Journal of the American Medical Association,* May 14,

* Read before the Harlem Medical Association of New York.

1904. In that paper I said: "In one of my cases there were daily chills as a result of a severe cystitis, and the urine contained a large amount of pus. After draining the bladder for ten days, the prostate was removed *in toto,* and the man made a splendid recovery. And that is just one of the advantages of the operation, that we can, in badly infected cases, first relieve the cystitis, and then, through the same opening, remove the prostate in a very few minutes." This was written in 1904. The details of the case may be of interest, as I had up to that time neither heard nor read of a two-stage prostatectomy. In all justice I should say that the character of the operation was forced upon me by the exigencies of the case.

M. L. M., seventy-five years old, referred by Dr. Henry S. Stark. In 1898 he suffered for two months from frequent and painful urination. Following this attack he was no longer able to pass his water, and thereafter had been catheterizing himself four or five times daily. During this time he had had frequent attacks of cystitis and orchitis. During the five days prior to his admission to the hospital the patient had an unusually severe attack of cystitis. He had a chill every day, accompanied by fever, anorexia, irregular pulse and a marked general depression. The urine withdrawn from the bladder contained large amounts of pus, and the catheter had to be passed every two hours. I was asked to see the man, not with the view of operating on him, as he was considered to be beyond the hope of cure, but simply to satisfy the relatives. By rectum the prostate was found considerably enlarged. The man's desperate condition precluded a radical operation. At the same time it was evident that if something were not done promptly he would die of sepsis. Suprapubic cystostomy was offered and accepted as a palliative procedure. On September 15, 1903, under eucaine and laughing gas, this operation was carried out. Three days later the man was allowed to sit up for an hour. His temperature became normal, the pus gradually disappeared from the urine, and his general condition improved materially. We were then confronted by the problem as to whether anything further could or should be done. In spite of his seventy-five years the man was still attending to his affairs, which necessitated his being out most of the day. After careful consideration, it was decided to do a prostatectomy under gas, through the incision which had already been made. This was done eleven days after the preliminary operation. The prostate was found firmly adherent to its capsule, and required considerable force for its removal. A gauze packing was left in the bladder. The operation consumed eight minutes, and was accompanied by very little bleeding. The tumor consisted of two lateral lobes, each the size of a small plum, and about an inch of urethra ran through the gland. Three days after the second operation the patient developed a bronchopneumonia of moderate severity. In ten days the temperature was again normal, and thereafter convalescence was rapid and uninterrupted. Four months after operation the man had gained 33 pounds; he was able to hold his water over four hours during the day and six hours at night, and there was no residual urine. This patient lived to be over eighty years and had no further urinary disturbances.

My second case was done in April, 1904, and was reported in a paper on Suprapubic Prostatectomy, in the ANNALS OF SURGERY, April, 1905. In this case the bladder was distended with blood clots and I deliberately advised the two-stage operation. The bladder was drained for ten days, and the entire prostate was removed at the second stage in less than two minutes. This man, who was seventy-five years old, lived to be over eighty with no further bladder trouble. Dr. Howard Lilienthal, in the ANNALS OF SURGERY, April, 1905, wrote: "The operation may be performed in two stages, which may be of enormous value in hemorrhage, in uræmia or in grave sepsis of the bladder, where catheterization is difficult, or painful, or dangerous." He further stated, "I have since employed this two-stage method to my great satisfaction, and I believe it to be one of the important advantages of the suprapubic operation." Chetwood, under Prostatectomy in Two Stages, in the ANNALS OF SURGERY, October, 1906, describes it as a conservative operation with minimum hazard. Chetwood did not refer either to Dr. Lilienthal's paper or to my two papers. This drew forth a letter of Lilienthal in the *Medical Record*, December 8, 1906. In this letter he drew attention to the fact that he had done his first two-stage prostatectomy in 1896. This case was not reported at the time, and I was not able to find the report of any other case prior to 1903 when I did my first case.

The late Follen Cabot in 1907 wrote of the two-stage operation: "To my mind this method is of great value, and from my own experience with it, I believe it will be used more and more as its merits are better understood. . . . I am also convinced that ether anæsthesia is the cause of many deaths in prostatics from kidney and lung complications following operation." He further stated that he would in future do the first stage under local anæsthesia. The writer recognized this fact at the very beginning of his work in this line, and was the first to advocate and to practise the operation without ether or chloroform. In fact all the writer's prostatectomies, both the one-stage and the two-stage operations, have been done either under local anæsthesia or under laughing gas.

It is really astonishing how long it took for foreign surgeons to recognize the value of this operation. A rather careful search of the foreign literature revealed but few reports, and even then it was usually recommended only for infected cases or for bad risks. Carlier, of Lille, in 1908 advised the two-stage operation in infected cases, and suggested an interval of several weeks between the two stages. In the same year Lanz, of Amsterdam, reported three badly infected cases

done under local anæsthesia. Done in this way he places the procedure in the category of "*ungefaehrliche Operationen.*" Cholzoff, of St. Petersburg, reported in 1910 that his mortality had been so much reduced by the two-stage operation that he had given up the operation at one sitting. He was led to this by the following experience. In eleven consecutive cases of operation in one stage he had three deaths. He then did twenty consecutive two-stage operations with only one death. Thereafter he always did the two-stage operation. He found considerable shock after the one stage operation even in patients in relatively good condition. He cites among the advantages of the newer operation, that after the first stage the inflammatory process in the bladder and kidneys subsides, absorption of toxic products ceases, the pressure of the dammed-back urine on the kidney parenchyma is relieved, and kidney function improves. Several of his cases before the first stage showed insufficient renal excretion, yet all these cases gradually improved after the preliminary cystotomy. He often waited three weeks before doing the second stage.

Kayser, reporting from Kummell's clinic in Hamburg in 1911, deplores the fact that the two-stage prostatectomy has not found more favor in Germany. He reported four cases, using only local anæsthesia. He cites three principal reasons for doing the operation. First, the age of the patient requires us to reduce shock to a minimum. Second, it enables us to treat the infected bladder and to relieve the kidneys that have been damaged by an ascending infection, or by the damming back of the urine. Third, it diminishes the danger of wound infection. Judd, reporting from the Mayo clinic in 1911, writes, "During the past few years we have not only been able to reduce our mortality materially but have secured a more satisfactory convalescence and better results. . . . With a permanent catheter in the urethra, or through a suprapubic stab wound, we divide the treatment into two stages, relieving the secondary symptoms first. This will enable the patient to eat, drink, sleep and improve generally in health. The second stage will be accomplished more satisfactorily and with more safety than if the preliminary treatment had not been instituted."

Lilienthal, in 1910, reported sixteen cases of the two-stage operation, in which the longest interval between the two stages was twenty days, and the shortest two days, with an average period of eight days.

In 1912, and again in 1914, P. M. Pilcher, of Brooklyn, advocated the two-stage operation as the operation of choice.

Freyer, of London, in 1912 after reporting one thousand cases of suprapubic prostatectomy, stated that in some cases he did the operation

in two stages. But he did not state the proportion of cases in which he did it, or what his indications were for so doing.

From the above papers, which fairly well cover the literature on this subject, it will be seen that the two-stage prostatectomy is slowly but surely becoming the operation of choice with an ever increasing number of surgeons. But, unfortunately, some still do the one-stage operation in many of their cases, and as a result, lives that should be saved by prostatectomy are added to the mortality list of the operation. There can be no doubt in the mind of any surgeon who has done the two-stage operation, often in desperate cases, that the mortality is appreciably lowered by that procedure. In regard to our personal experience, following the first two cases referred to above, we have resorted to the operation in an ever larger percentage of cases, until now we look upon it as the operation of choice in all cases of prostatic hypertrophy. And we have been led to this not only by our own experience, which we may say parenthetically was very satisfactory with the one-stage operation, but also by the experience of others, whose work we were able to follow. Whenever of late years we have heard of a death a few days after a primary prostatectomy, the question at once presented itself, would this man have died if the operation had been done in two stages? And we are glad to say that we have occasionally been able to persuade a surgeon that his patient would have had a better chance had that been done. And we have had a goodly number of cases ourselves who would certainly have succumbed if we had not done the operation in two sittings.

Some men say that if the patient is in good condition they do the operation at one sitting. How do we ever know that any of these old men are in good condition? We can make as many tests as we wish to determine the functional capacity of the kidneys—all of them will sometimes leave us sadly in the lurch in determining the ability of the patient to overcome the shock of operation. The same can be said of the most careful examination of all the other organs of the body. The cases that seem the poorest risks will sometimes show surprising resistance, while some of those apparently in good condition succumb to shock. I must confess that I cannot tell beforehand which of these cases is going to be badly shocked and which is not. Some of the most desperate cases, even well over 75 years old, have little or no shock. Others, younger and apparently in relatively good condition, are badly shocked by a simple cystotomy. The only safe rule is to look upon all these cases as bad risks, and to hedge them about with every known safeguard. They need them all; and in the better walks of life, they

need all the loving care and attention that their relatives can bestow upon them. Few surgeons will deny that in desperate cases the two-stage operation is the safer; but they will tell you that in good cases it is not necessary. And that is where the danger to the patient lies; that he will be taken for one of the "good" cases. And unfortunately some of those good cases, after a primary prostatectomy, turn out to be anything but good. Under these conditions what right have we to gamble about the patient's general condition? Bluntly expressed, that is what we do when we expose any old patient to the dangers of a prostatectomy at one sitting. Slowly but surely this fact is beginning to be recognized by surgeons in this country, and its fruitful seeds are beginning to sprout abroad.

We have no reliable statistics to compare the mortality of the one-stage and two-stage operations and we probably never will have. The cases vary too much; one man selects his cases and refuses to operate on desperate cases. Another man operates on all cases, whereas a third man reserves the two-stage operation for cases that he does not consider good risks. But we believe no fair-minded surgeon will gainsay that if we take one hundred consecutive cases and do the one-stage operation the mortality will be higher than if we take the same series of cases and do the two-stage operation. Why, then, does not every surgeon do the two-stage operation in every case; what are its supposed disadvantages? First and foremost, the lengthening of the time of healing. Those surgeons who limit the two-stage operation to infected cases naturally find that the convalescence is prolonged. If these men compare the healing time of these infected cases, done in two stages, with the healing time of their clean cases done at one sitting, there is naturally a considerable difference. The writer is able to testify to the correctness of this fact, as he himself for several years limited the two-stage operation to infected cases, and they did take longer to heal. But in uninfected cases the period of convalescence is but little lengthened. The suprapubic wound goes on granulating between the two stages, and the wound is finally healed almost as quickly as if the prostate had been removed at the first operation. But after all is the time of these old men so valuable that to save a few days, or even a week, we should endanger their lives? Second, the longer stay in bed. This objection falls away at once if we do not keep our cases in bed more than a day or two after either the first or the second stage of the operation. We encourage these cases not only to get out of bed early, but they are usually walking about the room on the third or fourth day after the cystotomy. In mild weather

we have these men sitting at the open window or going up on the roof between the two stages. It is surprising how much the general condition improves under this regime, and it is very gratifying to see how little shock there is in some of the most decrepit cases when it comes to the actual prostatectomy. Third, the danger of giving these old men ether twice is held up against the operation. This is a real objection if the surgeon finds it necessary to give ether twice. Personally I have never given ether or chloroform in any prostatectomy, whether done in one or two sittings. If done at one sitting, gas and oxygen are used; if done in two sittings the cystotomy is done under local anæsthesia, and the prostatectomy under gas and oxygen. We were the first to advocate doing prostatectomy without ether or chloroform twelve years ago, and we have never varied from this. The first stage can always be done almost painlessly under local anæsthesia. Many of these cases do not complain at all and in no case is it necessary to give even gas to open the bladder. And even the most difficult prostatectomy can be done under gas and oxygen. In a recent case the prostate almost filled a pint fruit jar, and yet it was removed under gas and oxygen. Fourth, the depressing mental effect on a patient of looking forward to a second operation. This is a real objection and must be overcome. Crile has shown that we should do everything possible to put the patient in the best condition to withstand shock, and we know from our work on the thyroid that fear increases postoperative morbidity as well as mortality. It is a very simple matter to remove this fear of a second operation. For years I have regularly lied to these cases, and told them that the prostate had been removed at the first sitting. When it comes time for the second stage I either tell them that a painful dressing must be done, or that I must put in a few stitches. Many of these old men did not know until long afterward that they had been deceived, and I have yet to meet a patient that resented such a deception. And it is really astonishing how little shock there is following the prostatectomy; many of these cases miss only one meal and are not much more shocked than they would be after a difficult dressing. We regularly find much more shock after the cystotomy than after the prostatectomy. And we are careful to wait until the patient is well over the shock of opening the bladder before removing the prostate. No fixed time is set for the second stage; it varies from a week upward, and we make it a rule not to remove the prostate until we feel that the general condition has improved as much as it will. In some cases we must proceed with the second stage before the general condition has become good. In the case of an old gentle-

man of seventy-eight, whom I operated on last summer, there were chills and temperatures up to 105° F. before the bladder was opened. Following this there was some improvement in the general condition, but the temperature rose daily to 102° F. I waited ten days and then decided that we could not hope for any further improvement until the prostate had been removed. Two hours before the prostatectomy there was a slight chill with a temperature of 103° F. In spite of this I removed the prostate which contained a small, foul-smelling abscess. The temperature then soon became normal and the patient is now hale and hearty at seventy-nine.

Having now answered, as well as we could, the various objections that have been brought forward against the two-stage prostatectomy let us see what the dangers of prostatectomy in general are, and how they are met by the operation we advocate.

The chief dangers of prostatectomy in general are suppression of urine, secondary shock, general toxæmia and, especially in congested prostates, profuse hemorrhage. To these must be added the dangers of the anæsthetic and pulmonary complications. The mortality rate will bear a very close relation to the existence of one or more of these features in any given case. In cases of hydronephrosis due to the damming back of the urine, the preliminary cystotomy gives the kidneys a chance to recover their normal tone before the prostate is removed. I believe that a mild form of hydronephrosis is present in these cases much oftener than is generally supposed. And it is often very difficult if not impossible to ascertain this condition before operation. We firmly believe that some of the deaths are due to this unrecognized condition. Five years ago we did a two-stage operation on a patient of fifty-seven, but unfortunately only waited three days between the two stages. The man died a few days after the prostatectomy, without having given any signs of a kidney lesion or of any functional kidney impairment. We insisted on doing an autopsy and were surprised to find advanced bilateral hydronephrosis; there was very little renal parenchyma left. Usually such advanced hydronephrosis will cause singultus, and this should be looked upon as a very dangerous symptom, as these cases regularly die. It is true that they die even if no operation is done; but we believe that they should not be operated on unless the hydronephrosis can first be relieved to such an extent that the singultus disappears. In my fatal case I found out after the patient's death that he had been having attacks of singultus for several weeks before operation, but for some reason he kept this fact from me. But there are many mild forms of hydronephrosis that give rise to no

symptoms and yet the kidney condition is a real menace to life, especially if the operation is done at one sitting. Regarding hemorrhage, I can truthfully say that since doing the two-stage operation this source of danger has been entirely eliminated. And it is often surprising to see how much shrinkage there is in an acutely inflamed prostate following the cystotomy. And does it not follow as a matter of course that there will be much less bleeding from a shrunken than from an acutely congested organ? And who will deny that there is more shock connected with the removal of an inflamed organ? And it is easy to see that the general toxænia will be greater if the prostate is removed while the bladder is more or less infected, as it is in the majority of our cases. The large raw surface left after the removal of the prostate is capable of considerable absorption, and we can lessen this absorption, not only by clearing up the urine before removing the prostate, but also by allowing the prostate to shrink before removing it, not to point out once more that the better the general condition of the patient the less danger will there be from general toxæmia. And it is this general toxæmia that we personally dread most in these old men. During the interval between the two stages, the general condition regularly improves, sometimes to a remarkable extent. The temperature becomes normal, the pulse slower and more regular, and the appetite improves. Regarding shock it has been our experience that there is more shock from the cystotomy than from the prostatectomy. I have been frequently surprised at the amount of shock to these old men from a simple opening of the bladder under gas, or even under local anæsthesia. It often takes ten days for them to get over the shock of this trivial procedure. Is it any wonder then that we will sometimes find serious and even fatal shock following a primary prostatectomy? It has aptly been said that if the preliminary cystotomy kills, it would have been foolhardy to do a prostatectomy. As a matter of fact the cystotomy does not kill; the prostate becomes less congested, the cystitis subsides, the wound is lined by protective granulations, the general condition improves markedly, the danger of hemorrhage and infection is reduced to a minimum, and some cases that would have died are saved. Granted the wound takes a little longer to heal, which it does not even do in every case, is it not worth while? After all what are we trying to do, make a record for quick convalescence or save lives? That the ideal field for the two-stage operation is the emergency case, whether in the presence of hemorrhage or not, there can be no doubt. But the surgeon who reserves the two-stage operation for the emergency cases does not give his patients the benefit of the safest pro-

cedure, and some of his cases that should recover unfortunately do not do so. The claim is sometimes made that with rapid operating the one-stage operation is no more dangerous than the two-stage. Nothing could be more fallacious than this form of argument. True it is, that a rapid one-stage operation will save some cases that would not survive a prolonged operation. But that is a long way from saying that even the most speedy one-stage operation will save some cases that we have saved and do save with the two-stage operation. The writer was one of the very first to point out the advantages of rapid operating in this class of cases, and in his papers on prostatectomy in 1904 and 1905 he insisted that the time of operation was an essential element in lowering operative mortality, and he altered his technic to save as many minutes as possible. And though it is true that our results improved as we were able to shorten the time of operation, yet even with the quickest possible operation the results were not as good as they now are with the two-stage operation. We can safely assert that no patient dies after the two-stage operation who would not have died after the primary prostatectomy. And we can state with even more assurance that a goodly number of patients, who would have died after the one-stage operation, are alive and well to-day because they had the benefits of the two-stage procedure. And is that not after all the crux of the whole problem? And as long as we have no way of determining before operation which of these old men stand shock well, and I wish to say with all possible emphasis that we have to-day no such method, the only safe thing to do is to assume that they all stand shock poorly and give them the benefit of the doubt by doing the safer operation. After twelve years' work in this field we are firmly convinced that we are doing the greatest good to the greatest number if we give up entirely the primary prostatectomy and give all of these old men the benefits of the two-stage operation.

PRIMARY TUBERCULOSIS OF THE PROSTATE GLAND*

By Irvin S. Koll, M.D.

of Chicago, Ill.

PROFESSOR OF GENITO-URINARY DISEASES WITH CHICAGO POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL
ASSOCIATE GENITO-URINARY SURGEON TO MICHAEL REESE HOSPITAL

A careful search of the literature shows but two probable cases of primary tuberculosis of the prostate reported. This is most surprising, and in all probability does not represent a true percentage of the primary invasion of the gland by the tubercle bacillus, but a deplorable failure on the part of surgeons to have careful histologic examinations made of their specimens.

In spite of the many opinions offered, we must confess our ignorance that we do not actually know the mechanism by which the tubercle bacillus invades the genital organs. It is therefore difficult to say absolutely whether a seeming primary genital or urinary tuberculosis is or is not secondary to some other focus, possibly from caseated peribronchial or mesenteric lymph-nodes.

The accompanying statistics compiled from a monograph on prostatic tuberculosis are of interest:

Cornet[1] found in 10,000 deaths from tuberculosis other than pulmonary 1 per cent. urogenital. Kapsammer found in 20,700 postmortems 1 per cent. urogenital tuberculosis. Oppenheim found that in 37 deaths from genito-urinary tuberculosis 30 had pulmonary involvement. Reclus, 100 cases genito-urinary tuberculosis, 98 had lung involvement. Desnos, 16 cases prostatic tuberculosis, 6 had lung involvement. Julien, 41 cases of prostatic tuberculosis, 23 had lung involvement. Krzywicki, 14 cases of prostatic tuberculosis, 12 had lung involvement. Oppenheim, 100 cases of prostatic tuberculosis, 81 had lung involvement. Rautberd, 100 cases of prostatic tuberculosis, 85 had lung involvement. Fenwick, 157 cases genito-urinary tuberculosis, 3 per cent. prostate alone involved (indefinite); 24 per cent. prostate and epididymi involved; 3 per cent. prostate and seminal vesicles involved; 6 per cent. prostate and bladder involved. Davids, 360 cases of genito-urinary tuberculosis, none primary in prostate. Hess, 23 cases of genito-urinary tuberculosis, none primary in prostate. Barney and Cabot,[2] 101 cases of genito-urinary tuberculosis, 75 per cent. prostate involved. Guisy,[3] 183 cases of genito-urinary tuberculosis; 10 involving prostate and vesicles alone; 5 prostate alone (records indefinite).

*Read at the Annual Meeting of the American Urological Association, Baltimore, April, 1915.

[1] Hesse: Tuberculose der Prostata. Jena, November, 1913.

[2] Barney and Cabot: J. A. M. A., December 6, 1913.

[3] Ann. d. Mal. des Org. Genito-Urinaire, 1906, vol. i.

I am indebted to Dr. Harry Jackson, Pathologist to the Cook County Hospital, for the clinical history and specimen of tuberculosis of the prostate with extension into the bladder (Figs. 1, 2 and 3). The process in the prostate is evidently primary for the genito-urinary organs. The patient entered the tuberculosis ward of the hospital on account of cough, loss of weight and general cachexia. He did not complain of any urinary symptoms and, other than a notation that the external genitals were negative, there is no record of any physical examinations of his genito-urinary tract. He died two months later. Autopsy gave the following findings: Acute disseminated miliary tuberculosis of all the lobes of the lungs; chronic ulcerative tuberculosis of the intestines; chronic nephritis; no evidence of any tuberculous process; marked fibrocaseous tuberculosis of the prostate: tuberculous ulceration of the internal urethral orifice; bladder mucosa normal.

The two cases found in the literature are as follows:

CASE I.[4]—Patient, aged seventy. Diagnosis: Prostatic hypertrophy. Small nodules felt per rectum. The other genito-urinary organs were normal, as far as could be determined. Recovery complete in seven weeks.

CASE II.[5]—Primary prostatic tuberculosis. All other genito-urinary organs healthy. Perineal prostatectomy. Patient died later from tuberculosis meningitis.

The author's case (Figs. 4 and 5), aged sixty-one, entered the genito-urinary service of the Michael Reese Hospital, giving the typical symptoms of prostatic obstruction; complete retention having occurred four days previously. The only point of interest in the history is presence of a cough, which had been present for several years. Physical examination of chest and abdomen was entirely negative. Per rectum, the prostate felt about three times its normal size, consistency firm, surface smooth, except for two or three small nodules, which did not seem unusual. Cystoscopic examination revealed nothing except a low grade of cystitis. The median lobe protruded considerably into the bladder.

Under local anæsthesia the bladder was opened and drained by Dr. Kolischer, by whom, ten days later, the case was turned over to the writer for removal of the prostate. The patient was in the hospital five months, on account of a persistent fistula, which was uninfluenced by gradually increasing doses of tuberculin subcutaneously. This was started as soon as tuberculosis was reported by the pathologist. It is of interest to note that there was not the slightest reaction to the tuberculin, even in one milligramme doses. This is strongly suggestive that there was no other tuber-

[4] Wulff: Deut. med. Woch., 1909, p. 1332.

[5] Burckhardt: Muench. med. Woch., 1911, p. 1750.

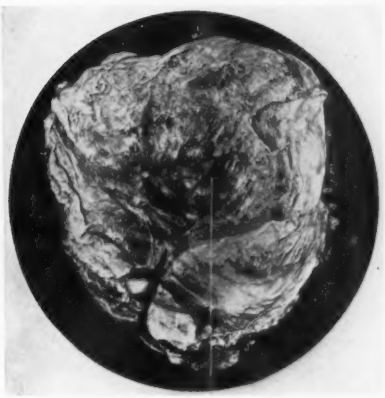


FIG. 1.—Autopsy specimen. Bladder opened. Ulceration around internal urethral orifice (*x*).

FIG. 2.—Autopsy specimen, showing extensive involvement of the prostate. *x*, urethral orifice.

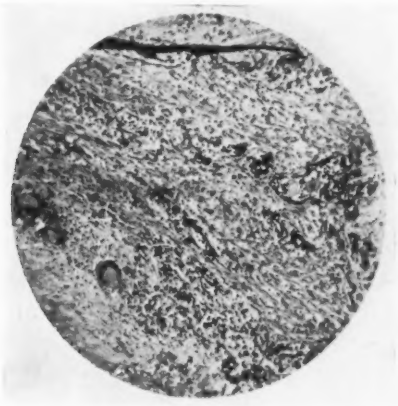


FIG. 3.—Autopsy case, showing tubercle with giant-cells and caseation; also prostatic tubule with amyloid body.

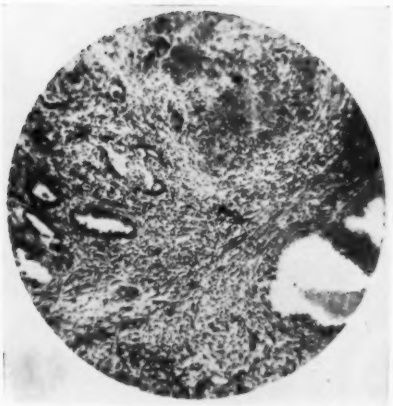


FIG. 4.—Author's case, showing formation, caseation and some normal prostatic tubules.

FIG. 5.—Author's case, showing high degree of infiltration.

culous focus in the body, at least active. The patient finally left the hospital. He underwent a subsequent operation for closure of the fistula, which has remained closed. Unfortunately, I have not been permitted to make a cystoscopic examination, but the patient assures me that except for occasional frequency he is quite free from any urinary disturbance. His urine contains considerable pus. Per rectum there is nothing abnormal to be felt. No tubercle bacilli can be found in the urine.

The histologic findings by Dr. Edwin Kirk, hospital pathologist, are as follows: "Prostate gland about 6 cm. long, 4.5 cm. wide. Both lateral lobes swollen, middle lobe enlarged. Two or three wart-like excrescences on posterior aspect of one lateral lobe. Gland feels hard, rather nodular. Small whitish areas looking like caseated or necrotic areas. Paraffin sections show typical tuberculosis of prostate with some caseation and considerable glandular hyperplasia; diffuse but local in distribution.

"On tubercle stain, the tubercle bacilli are found in several of the caseated areas, the rod form, and in one area the streptothrix type."

PATHOLOGIC LESIONS OBSERVED IN THE POSTERIOR MALE URETHRA BY MEANS OF THE URETHROSCOPE*

AS SHOWN BY A SERIES OF PHOTOGRAPHS FROM WAX MODELS

By Abr. L. Wolbarst, M.D.
of New York

Wax models have frequently been used to demonstrate pathologic as well as normal conditions in various parts of the human anatomy, but I have never seen any models of the lesions which we so often find in the deep male urethra with the aid of the modern urethroscopes. The models herewith exhibited (Figs. 1–20) were begun in a modest way as an interesting and useful diversion, rather than with any other object in view. The results proved so satisfactory, that this method of perpetuating the appearance of the deep urethra has recently been applied to all cases presenting unusual or interesting conditions. By this means we are also enabled to make comparison of the conditions before and after the institution of local treatment.

The material used is the ordinary red modelling wax (plastiline) employed by sculptors. It may be said in passing, that colors in oil may be applied easily, thereby enhancing and preserving the beautiful views observed with the urethroscope. At the time of the examination of the patient, a rough pencil sketch of the lesion is made, and as soon thereafter as time permits, while the picture is still fresh in the mind's eye, the model is made, encased in a box specially made for this purpose. The box is of white wood, stained in any color desired, 5 inches long, 3 inches wide, 1½ inches high (Fig. *A*). The cover is of glass which slides in and out in a groove, so that, when the model is completed, the glass cover may be sealed in place by a strip of gummed cloth tape, thereby keeping out the dust and preventing handling of the model. From time to time, as the patient comes for treatment, any faults in the model may be corrected, making it more nearly perfect.

Photographs may be easily made, by removing the glass cover; the model, being solid, gives us a far more effective picture in three dimensions than any drawing or painting made by an artist, which must necessarily be flat. This makes reproduction of the lesion for publication much more striking than the flat drawing of the artist.

Apart from their value as above mentioned, these models may be employed to show the patient his particular lesion, both as to its location and character. In many of these cases involving the deep urethra,

* Presented before the American Urological Association, April 15, 1915.

FIG. A.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

FIG. 10.

FIG. 11.

FIG. 12.

FIG. 13.

FIG. 14.

FIG. 15.

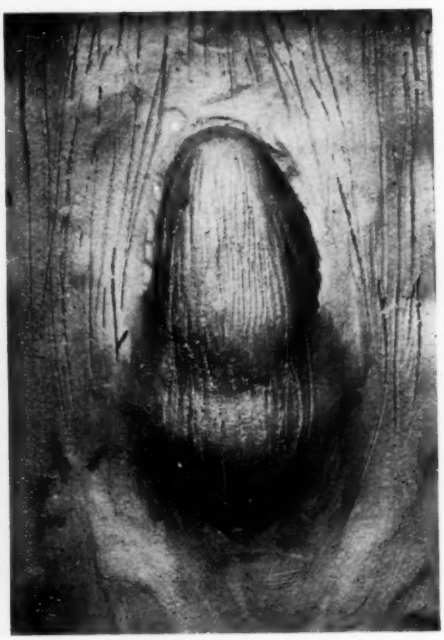


FIG. 16.

FIG. 17.

FIG. 18.

FIG. 19.

FIG. 20.

the neurotic factor is well marked, and it is possible to relieve the mental distress and anxiety of some of these patients by demonstrating to them just where their ailment is and what the lesion looks like to the examining eye. As a result, patients are far more ready to accept the temporary annoyance and inconvenience of repeated urethroscopic applications than they would be otherwise. The effect is similar to that produced on patients by a radiograph. Moreover, they can be shown the progress which is being made in their individual case, by a comparison of the model made at the beginning of the treatment with that made at subsequent examinations. I consider this a decided help in securing the coöperation and sympathy of the patient, in the task of restoring his deep urethra as nearly as possible to the normal.

The instrument used in studying these cases is the McCarthy modification of the Buerger Cysto-urethroscope made by Wappler, of New York. The models represent, as nearly as possible, the views obtained by the aid of this instrument, both as to size and configuration. In every case, only the more striking features of the view have been represented, inasmuch as it is hoped that each model will have its own particular lesson to teach.

For the purpose of identification, the models have been numbered. Briefly they may be described as showing the following conditions:

1. Large veru, utricle and prostatic sinuses enormously dilated, posterior median ridge extending to the bladder neck. Clinically, premature ejaculation and partial impotence.

2. Normal pointed veru; multiple polypi or papillomata on the superior margin of the internal sphincter. Clinically, urinary frequency and tenesmus.

3. Large ulcer near the veru, which is much enlarged; small, healed ulcer at the anterior or proximal apex of the flattened veru. Clinically, very frequent and painful micturition, night and day. Tuberculous hip-joint and nodular prostate. Probably a tuberculous ulcer of the posterior urethra.

4. Veru distorted and hypertrophied beyond recognition; anterior surface is scalloped, while masses of tissue project from its sides and from its anterior and superior aspect. Clinically, urinary distress and sexual neuroses.

5. Veru moderately enlarged; prostatic sinuses enormously dilated; postmontane floor of urethra trabeculated and cut up into ruts of varying depths. Clinically, pain in perineum lasting fifteen years after an acute posterior gonorrhœa.

6. Same case as No. 5, after three months of treatment. The postmontane ruts are gradually disappearing, the mucosa is more nearly normal in color, and the sinuses on either side of the veru are becoming smaller. Clinically, patient feels much relieved of his pains.

7. Large veru, with tissue growth posteriorly; papillomata or polypi anteriorly and posteriorly. No clinical symptoms, except sterility and azoöspermia.

8. Veru somewhat atrophied, moderate trabeculation of postmontane floor; a thick ridge anteriorly. Clinically, frequent nocturnal emissions for over ten years.

9. Veru enormously hypertrophied, with tissue masses resembling horns projecting into the urethra; utricle dilated. Clinically, recurrent chronic gonorrhœal urethritis.

10. Same case as preceding, after six months of treatment. The "horns" have disappeared and the veru is resuming its normal size and shape. The anterior ridge leading to the veru has not responded to the local applications. Clinically, much improvement in patient's condition.

11. Enlarged veru, and covered with cystic bodies which were punctured and cut out with the operating scissors and punch. Clinically, negative except azoöspermia.

12. Large deformed veru, with thick ridge on postmontane floor. Clinically, chronic recurrent gonorrhœal urethritis.

13. Veru very large, utricle enormously dilated, postmontane floor cut up into deep ruts extending to the vesical neck; cystic bodies on right posterior urethral wall; large mass of tissue projecting from right side of veru near the urethral floor. Clinically, chronic gonorrhœa.

14. Same as preceding, after four months of treatment. Marked improvement visually and clinically.

15. Veru elongated, resembling a human finger. Clinically, urinary frequency and partial impotence.

16. Same case as preceding after seven months of treatment. Veru is resuming its normal outline, though still enlarged. Clinically, urinary symptoms relieved, but impotence unchanged.

17. Posterior urethra, after prostatectomy, showing deep groove taking place of prostate and veru, and demonstrating filiform emanating from the torn common ejaculatory duct. Strangely enough, the operator evidently overlooked the large papilloma on the base of the bladder and the cystic bodies attached to the internal sphincter. Clinically, frequent and painful urination, with cystitis.

18. Unusually large and deformed veru, scalloped, and elevated above the urethral floor; thick anterior ridge. Clinically, sexual neuroses following chronic gonorrhœa; also obstruction to urinary stream.

19. Same case as preceding after five months of treatment. Marked improvement as to size and shape of veru, and also clinically.

20. Veru quite normal, flat type; unhealed ulcer anteriorly and on the same side posteriorly, a well-marked tearing of the postmontane floor, evidently a false passage made by faulty instrumentation. Patient had been treated for a long time with sounds, occasionally causing severe pain and bleeding. Clinically, chronic gonorrhœa with frequent exacerbations.

If any comment might be made after a careful study of these models, one might confess to being struck by the fact that the clinical phenomena are often inversely out of all proportion to the serious pathologic changes, and, conversely, that slight lesions in the deep urethra often produce marked clinical phenomena of divergent character and great obstinacy. It is also apparent that the modern posterior urethroscope has revealed a wealth of urethral pathology which was hitherto undreamed of. One often wonders how these lesions were ever cured, without the aid of this instrument.

A MODE FOR VENTROFIXATION OF THE UTERUS FOR THE RELIEF OF PROLAPSUS

By J. O'Conor, M.D.
of Buenos Ayres, Arg.
senior medical officer of the british hospital

Attention is invited to a method of cœliohysteropexy, which has for some years past been adopted by the author in the treatment of uterine prolapse, and in cases of retroflexion with symptoms.

During the past twenty years various methods have been tried but none have been found as effective as the one below described, due possibly to the fact that it conforms with anatomical principles. "The position occupied by the uterus in the pelvis is not always the same, as it varies to some extent with the condition of neighboring organs, the lower cervical part is, however, much more firmly fixed in place than the body and fundus, which possess a considerable amount of mobility" (Cunningham).

In the writer's opinion the dominant factor in uterine prolapse is the relaxation of the cervical attachments, and any operation worthy of the name should therefore aim at fixation of the cervix. Cunningham further states that, "The muscular coat of the cervix contains more connective and elastic tissue than that of the body, and hence the greater firmness and rigidity of the cervical part of uterus." The operation described endeavors to restore the cervix to its positive position—the keystone of support of pelvic organs—by fixing it to the recti muscles in the following manner:

The abdomen is opened by the usual low central incision and the uterus exposed, any coexisting adnexal disease or adhesions are dealt with, the uterus is then drawn well up into the wound, and a transverse incision is made through the uterine peritoneum, just above and parallel to the utero-vesical peritoneal reflection (corresponding to the preliminary utero-peritoneal incision in hysterectomy) (Fig. 1). The peritoneum, with bladder, is reflected downward and forward until a space of about one inch square is left denuded on the anterior surface of the cervix. The uterine peritoneum on each side of exposed area is retracted and three strong (11 day) catgut sutures are passed, about one-third inch apart, through the exposed portion of the cervix, and sufficiently deep to obtain a firm grip of the cervical muscular coat (Fig. 2). The ends of the sutures are drawn out on each side, respectively, through the recti muscles by a Childe's ligature forceps.

Thus the peritoneum is excluded and the denuded surface of cervix is brought into direct apposition with the recti (Fig. 3).

In order to avoid subsequent intestinal adhesions at the site of fixation, the parietal wound is closed by tier sutures, the first suture purposely including the uterine peritoneum well above the denuded area (Fig. 3, *A*). In uncomplicated cases it is at maximum a fifteen minute operation. In most of the cases of uterine prolapse the first step is dilatation and curettage if endometritis exists; if cervix is ulcerated or hypertrophied and elongated, the vaginal portion is excised; then an anterior or posterior (or both) colporrhaphy is done. In many cases there is added cœliohysteropexy.

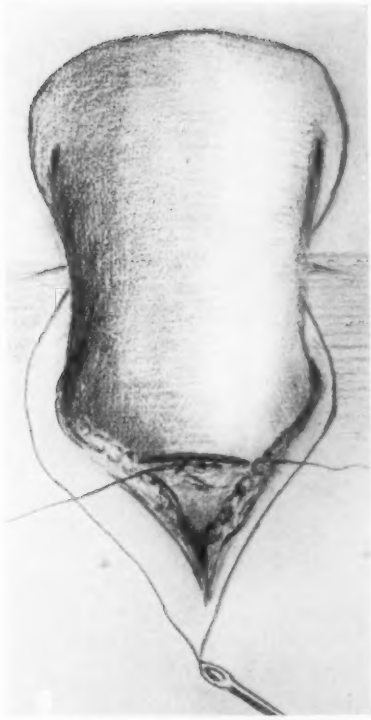


FIG. 1.—Uterus drawn out through central incision and transverse incision made through the peritoneum at vesico-uterine reflexion.

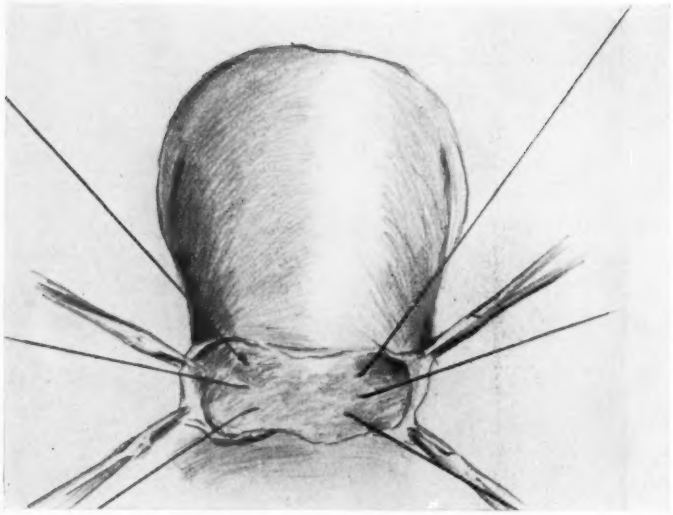


FIG. 2.—Three "cervical" sutures inserted. Uterine peritoneum retracted by forceps.

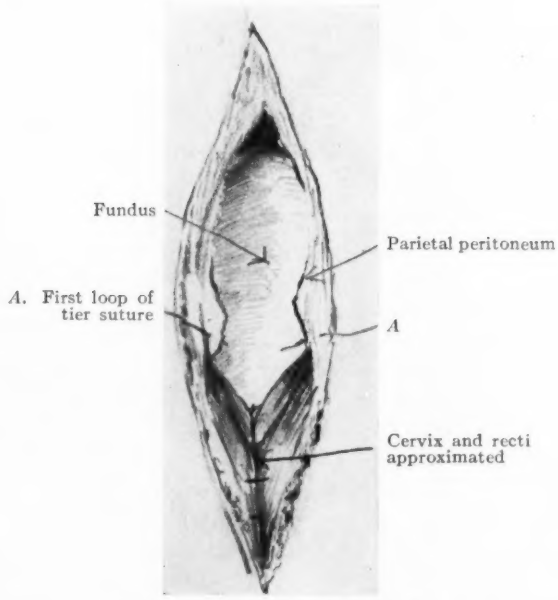


FIG. 3.—The ventrofixation completed.

TENDON FIXATION IN INFANTILE PARALYSIS*

OBSERVATIONS BASED ON ONE HUNDRED OPERATIONS

By W. E. Gallie, M.B.,

of Toronto, Canada

ASSOCIATE SURGEON TO THE HOSPITAL FOR SICK CHILDREN

A PRELIMINARY report of the procedure described in this paper appeared in the ANNALS OF SURGERY, March, 1913, describing the technic and the immediate results of six operations performed during the previous year. Sufficient time has now elapsed to warrant the expression of an opinion on the character and permanence of these results and on the value of the method in its general application to paralytic deformities. Since the publication of the preliminary reports, it has been brought to the notice of the writer that a similar principle has been tried by others, notably, Tilanus [1] of Amsterdam, Sangiorgi [2] of Bologna, and Reiner [3] of Vienna. The technic employed by these operators differs considerably from that described by the writer, but the general principle of the conversion of the tendons of paralyzed muscles into ligaments is the central idea of all.

Only minor changes have been made in the technic from that previously described. It consists of drawing the tendon of the paralyzed muscle taut and burying it in the bone in such a way that, after firm healing has occurred, the tendon prevents the part returning to its former position of deformity (Fig. 1).

Naturally many questions presented themselves as to the probable outcome of such a procedure, which could only be answered by the lapse of time. First, could the tendon be expected to unite sufficiently solidly to the bone to prevent the strain of opposing muscles or of the patient's weight from pulling it loose? Second, would the tendon stretch under this strain? Third, if the patient is a child, would the tendon grow at the same rate as the rest of the limb and so avoid allowing a recurrence of the deformity or the production of a new deformity in the reverse direction?

After the lapse of three years we are now in a position to answer

* Read before the Academy of Medicine, Toronto.

[1] Ned. Tijdschrift voor Geneeskunde, 1898, II, No. 23.

[2] Revista de Ortopedia, 1901, No. 1.

[3] Zeitschrift fur Orthopædische Chirurgie, 1903, No. 2.

these questions. First, the tendon will unite solidly to the bone and no strain to which any of the patients are normally subjected will be sufficient to loosen it. Second, tendons do not stretch. Third, the rate of growth of the tendon between its point of artificial fixation and its point of insertion, as demonstrated in young children whose limbs have doubled in size in three years, is practically at the same rate as the growth in the rest of the limb. It may be necessary to modify this statement as time goes on, but in the meantime our anxiety on this point is much reduced.

The simplest type of deformity to which the method is applicable is that of varus, which results from paralysis of the peronei (Fig. 2). After the application of a tourniquet, a curved incision is made over the external malleolus, exposing the peronei tendons. The tendon sheaths are split and the tendons are freed of all attachment to the sheath. A vertical incision is then made through the periosteum on the outer aspect of the lower end of the fibula, towards the anterior border, extending upward about two and a half inches from the extreme tip of the bone. With a periosteal elevator the periosteum is raised for an eighth of an inch or more on either side of the incision, and, in the case of the epiphysis and epiphyseal cartilage, the perichondrium and a flake of cartilage are raised with a knife. With a gouge of suitable size a trough is then cut in the bone and cartilage, extending the full length of the periosteal and perichondrial incisions, and of sufficient depth to allow of one of the tendons being completely buried in it. The varus deformity having been corrected, forcible manipulation being employed if necessary, the tendon of the peroneus longus is laid in the trough and drawn taut by an assistant, who holds the foot in a correct position with one hand and tightens the tendon with the assistance of a pair of Kocher clamps with the other. The surgeon then passes a medium-sized kangaroo tendon suture twice through the tendon and through the cartilage on either side of the groove, at the lower end of the incision, and by tying the suture over the tendon, firmly fastens the latter in position. When this suture has been tied, the surgeon's assistant should gently let go his grip on the foot, and thus test the solidity of the fixation. If the position is not correct the suture should be readjusted. The periosteum is then sewn over the tendon as it lies in its groove, with No. 1 catgut. A similar groove is prepared for the peroneus brevis tendon on the posterior surface of the fibula, exactly subjacent to the normal position of the tendon, and a similar operation is performed. The reason for making one groove anteriorly and the other posteriorly in this operation is that by this means the two tendons balance one

FIG. 1.—All the structures have been removed from the skeleton except the tibialis anticus muscle and its tendon and part of the annular ligament. The tendon has been buried in the tibia with a view to preventing foot drop. The kangaroo tendon anchoring-stitch and the catgut stitch in the periosteum are shown.

FIG. 2.—The tendon of the peroneus longus has been fixed in the anterior border of the external malleolus and the tendon of the peroneus brevis is ready to be laid in the trough prepared for it behind the malleolus.

FIG. 3.—Photographs of casts of the same foot made before and after operation. The figure to the right shows deformity of equino-varus. The figure to the left shows the same foot three months later after fixation of the peronei tendons.

FIG. 4.—The tendo Achillis has been fixed in the posterior surface of the tibia to prevent the deformity of calcaneus. In addition the tendons of the peronei, which are active, have been transplanted into the os calcis. The flexor longus-hallucis and the posterior tibial vessels and nerves are indicated. The tibialis posticus muscle should also be seen.

FIG. 5.—Casts of a case of calcaneus, made before and after operation. The tendo Achillis was buried in the back of the tibia as described. The figure to the right is a cast of both the patient's foot and the floor, made in one piece and shows the foot supporting the full body weight. Note the free space under the heel indicating the efficiency of the fixation.

FIG. 6.—Casts of a case of valgus. The figure to the right shows the foot in the deformed attitude, carrying the full body weight. The figure to the left shows the same foot after fixation of the tibialis anticus and posticus tendons. In each case the foot and pedestal are cast in one piece.

FIG. 7.—Diagram of operation for partial paralysis of triceps suræ. The tendo Achillis has been split and the anterior half cut free from the muscle and pulled through a small hole in the anterior wall of the sheath. This part of the tendon has then been buried in the tibia. The sheath has been sewn over the rest of the tendon with fine catgut. The peronei which are active have been transplanted into the os calcis.

FIG. 8.—Casts of a case of calcaneo-valgus resulting from partial paralysis of the triceps suræ The figure to the left shows the foot before operation. The figure to the right shows the foot after tendon lengthening was performed on the tibialis anticus, tendon fixation of half of the tendo Achillis, as described, and fixation of the tibialis posticus, to prevent the valgus. The cast was taken with the patient standing, and the space under the heel shows the strength of the fixation.

another. If both peronei were drawn taut in their normal position behind the malleolus, the result would be plantar flexion or equinus, in addition to abduction, but by placing one tendon in front and one behind, equinus deformity is prevented. The skin incision is closed with catgut and horse-hair, and a plaster bandage is applied extending from the toes to the knee. After six weeks the patient is allowed to walk and two weeks later the plaster is removed. Possibly a shorter fixation period would be sufficient, but as yet this has not been determined.

The results of this operation have been most gratifying. The patient is able to walk without splints of any kind and, if the peronei are the only muscles in the limb which are affected, he walks without limp. Fortunately the elimination of the possibility of adducting the foot is of no disadvantage to the patient in walking and running, and consequently many of these patients are practically completely cured (Fig. 3).

Another simple deformity to which this method of treatment is applicable is that of calcaneus, which results from paralysis of the triceps suræ muscle. With the patient lying face downward an incision is made along the whole length of the outer side of the tendo Achillis (Fig. 4). The sheath is split throughout the length of the incision and the tendon exposed. It is thoroughly freed from its attachments to the sheath and retracted inward so as to expose the fibrous covering of the deep muscles of the leg. A vertical incision is made through this sheath (which is the intermuscular septum between the deep and superficial layers of the flexor muscles of the leg) and the flexor longus hallucis comes into view. This muscle is then retracted inward, exposing the posterior surface of the shaft and lower extremity of the tibia. It may be necessary to divide a few of its fibres of origin from the fibula and interosseous membrane in order that sufficient length of the tibia may be exposed. A vertical incision is then made through periosteum in the middle line of the posterior surface of the tibia and the periosteum raised as in the peroneal operation. With a large gouge a trough is cut in the tibia, from two to two and a half inches long, extending into the medullary cavity. This trough usually extends across the epiphyseal cartilage and slightly into the epiphysis. The tendo Achillis is then buried in the trough in exactly the same way as in the peroneal operation. If the patient has a short leg the tendon may be fastened in such a way as to produce a slight fixed equinus, and if not, the range of dorsiflexion is locked at about a right angle. The incision is closed with catgut and horse-hair, and a plaster bandage applied.

The results of this operation up to the present have been excellent. Before operation the patient walks only on the heel. The arch is much exaggerated and, because of the patient's inability to support weight on the forepart of the foot, his gait is most ungainly. Practically all these patients keep the knee stiff in walking and so add to the degree of limping. Within a short time after the removal of the dressings a great improvement in gait develops. The patient now walks naturally, using both heel and toe, and bends the knee properly with each step. Within a month the exaggeration of the arch disappears or shows marked improvement, and on superficial examination the foot may appear normal. Closer examination of course shows the absence of the natural spring to the step which indicates active calf muscles (Fig. 5).

In addition to the simple operations described for varus and calcaneus, the method is equally applicable to the various deformities that result from paralysis of the triceps suræ and of the tibialis posticus muscles. Here, in addition to a fixation of the tendo Achillis, one does a fixation of the tibialis posticus tendon into that portion of the tibia subjacent to its own groove. It has been our custom to give these patients the additional support of a flat-foot brace.

Similarly, paralytic equinus is treated by fixation of the tibialis anticus; equino-varus, by fixation of the tibialis anticus and of the peronei; valgus, by fixation of the tibialis posticus, and equino-valgus, by fixation of the tibialis anticus and tibialis posticus (Fig. 6).

There are, however, some important modifications of the technic which deserve consideration. In the first 75 operations the muscles whose tendons were fixed had been completely paralyzed for more than two years. But cases were occasionally presenting themselves in which deformities were present in spite of a partial recovery of the muscle. Obviously it would not be wise to do a tendon fixation in such cases and yet the deformity calls as urgently for treatment here as in the cases of complete paralysis. To combat such conditions the experiment was tried of doing a fixation of half of the tendon and leaving the other half free to carry out the function of the normal tendon. The operation was first tried on a case of calcaneus in which about one-quarter of the normal power was present in the triceps suræ. This case was reported in the ANNALS OF SURGERY, January, 1915. The preliminary details of the operation are the same as already described for calcaneus. When the tendon has been exposed it is split longitudinally into an anterior and a posterior half and at the upper end of the incision in the tendon the anterior half is cut free from the muscle. This piece of tendon is then threaded through a small hole in the an-

terior wall of the sheath and fixed in a groove in the bone as above described, locking the foot at a right angle. Finally, the sheath of the tendo Achillis is sewn over the other half of the tendon with fine catgut and the wound closed as usual (Fig. 7).

Six cases have been treated in this manner with excellent results. Not only do the patients have a permanent locking of the foot at a right angle when the foot is dorsiflexed, but they are able to plantarflex the foot voluntarily to the normal range. This enables them to walk with a certain amount of spring to the gait as the weight leaves the ball of the foot. The half of the tendon which was left attached to the muscle increases to the normal thickness (Fig. 8).

This principle has also been employed in cases of varus in which there is partial power in the peronei muscles, and the results are equally gratifying.

In relation to these cases of partial paralysis an interesting observation has been made. After the patient begins to walk again there is a rapid improvement in the power of the partially paralyzed muscle and in a few weeks the power will be much greater than before the operation. This is probably accounted for by the elimination of the constant overstretching of the weak muscle. It now gets plenty of exercise without ever being overstretched, and consequently increases in size and power. This explanation is based on Robert Jones' observation that the paralyzed muscles recover more rapidly and more fully if overstretching is prevented.

Frequently other operations may be combined advantageously with "tendon fixation." Thus in calcaneo-valgus a favorite operation is that described by Nicoladoni, namely, transplantation of the peronei tendons, when these muscles are active, into the os calcis. This has been combined with fixation of the tendo Achillis on many occasions and works satisfactorily (see Fig. 4). Similarly, fixation of the tibialis anticus for equinus has been combined with transplantation of the extensor longus hallucis into the first metatarsal.

On several occasions also, in cases of severe equino-varus, fixation of the peronei has been combined with excision of bone from the outer side of the foot and arthrodesis of the midtarsal joint. The combination seems to be successful.

Recently an opportunity occurred to obtain a section of a fibula in which a tendon fixation of one of the peronei had been done a year before. Sections have been made transversely and longitudinally through the tendon as it lies in its groove. The microscopic appearances show the tendon united intimately to the subjacent bone by

short bands of fibrous tissue. These fibres run around and through the tendon and are very intimately attached to the bone. The bone is irregular in outline, presenting many minute openings under the tendon. Into these openings the strands of fibrous tissue run, sometimes ending in the bone and sometimes emerging from neighboring openings to lose themselves again in the tendon. In some places the fibres can be traced into the bone, and in others the dividing line between bone and fibrous tissue is quite indefinite, owing to the intimate mixture of the two. The periosteum over the tendon is solidly united to it and it is interesting to note that there is no sign of new bone formation between the tendon and periosteum.

Since the publication of the first communication on this subject, approximately 100 operations have been performed. All have healed by primary union and all except two have been decidedly improved. The first of these two cases was a complete failure, the deformity of varus recurring immediately after the child was allowed to walk. The operation was repeated and it was found that in planting the tendon in its groove its sheath was buried with it and as a result the groove in the bone was lined with synovial membrane and consequently no fixation occurred. Since this failure we have been careful to scarify the tendons before burying them. The second case was a failure simply because the foot was allowed to change its position after the sutures had been inserted and the tendon was drawn loose from its groove. It is well to remember that after the plaster is removed the foot will remain where the tendons held it before the plaster was applied, that is to say, the result depends directly upon the perfection of the technic.

With an experience extending over a period of three years and derived from the application of this method to over one hundred cases, the writer now feels himself in a position to recommend this operative procedure. The chief point in its favor is its efficiency in preventing recurrence of the deformity. This is accomplished in a manner so closely resembling the normal that mobility of the limb is preserved in all directions except the one in which it is wished to prevent motion. It has thus an advantage over arthrodesis. It is equally applicable to all ages, the same success attending operations on patients of four years of age as on adults. The more recent development of using one-half of a tendon for fixation, in cases of deformities accompanying paralysis from which partial recovery has occurred, greatly widens the field of its usefulness, and in the practice of the writer has practically eliminated the operation of silk ligament installation. In cases of severe calcaneo-valgus and danglefoot, it undoubtedly compares unfavorably

with astragalectomy as suggested by Whitman, but in the more moderate cases, such as those shown in the illustrations, it has the advantage of preserving the length of the limb and avoiding additional deformity.

The only element of doubt as to the permanence of the results arises from the question of growth, as pointed out above, and naturally, many years must pass before an absolute statement can be given. From present indications, however, it seems likely that the rate of growth of the tendon and of the rest of the limb will continue in the same ratio, so that we no longer hesitate to apply the method to whatever suitable cases present themselves for treatment.

CORRECTIVE OTOPLASTY*

A REPORT OF TWO CASES

By Jesse Wright Downey, Jr., M.D.

of Baltimore

SURGEON TO THE BALTIMORE EYE, EAR AND THROAT HOSPITAL; FELLOW OF THE AMERICAN COLLEGE OF SURGEONS

Otoplasty, or the correction by operation of abnormalities in size, shape and position, congenital or due to injury, of the auricle, being, as a rule, without functional benefit, may be truly termed cosmetic surgery. We should not assume, however, that the indication for such an operation is entirely based upon the desire of the patient to be "better looking," for in some instances the improvement in facial configuration is of economic importance to the individual, who is undoubtedly handicapped by an unprepossessing appearance.

The two cases which I wish to report were operated on within a few weeks of each other. The first patient was a man of twenty-seven years of age, the second patient a boy of nine. The deformities were congenital in both instances, consisting of a malposition only in the case of the man, and of a malposition and malformation in the boy. The first case was, by far, the simpler of the two, and by following a modification of the method of Kolle a most excellent result was obtained. The second case presented specific difficulties, as most plastic procedures must; the outcome, however, is very satisfactory.

Preliminary to a description of the cases in point we should consider briefly what constitutes a normal ear in size, shape and position, and the structural framework of the auricle; for before attempting to remedy a deformity we must have a definite standard for comparative purposes and must also understand the nature of the tissues on which the success of the operation depends. Blake and Reik[1] give the following description of a standard normal ear: "It should be, approximately, twice as long as it is broad, and its relation of attachment to the head should form an angle of not less than fifteen and not more than thirty degrees therewith. It should have a well-defined helix, separated from the antihelix by a distinct scaphoid fossa extending down nearly to the level of the antitragus. The root of the helix should

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* Read before the Baltimore City Medical Society, December 18, 1914.

[1] Blake-Reik: Surgical Pathology and Treatment of Diseases of the Ear.

be lost in the concha before reaching the antihelix, which should not be unduly prominent and should have a well-marked bifurcation at its superextremity. The lobule ought to be shapely and not adherent to the cheek along its anterior border nor yet too pendulous."

The structure of the auricle, it will be remembered, is mainly a plate of yellow fibrocartilage from one to three millimetres thick, folded in various convolutions. The skin covering the cartilage is thin and closely adherent, especially on the concave aspect. The muscles and ligaments are rudimentary and of but minor importance. It will be obvious that variations from the normal in shape and position of the auricle must be due to abnormalities in the shape and position of the cartilaginous framework, and the remodelling of this skeletal tissue becomes, therefore, the most important step in the operation. Even in a simple case of protruding ears, the normal elasticity of the cartilage would soon overcome what effect might be gained by the removal only of an area of skin; on the other hand, an excessive removal of cartilage would mar the symmetry of the anterior convolutions. It should be decided beforehand, then, just what portion of the cartilage should be removed and what portion may be bent into shape the more nearly to conform to the standard ear.

The preparation of the field of operation should be the same as for any major surgical procedure. The hair should be shaved over an area of two inches above and behind the ear. The patient should receive a general anæsthetic. It should be needless to say that the strictest asepsis is imperative.

The instruments required are, a sharp medium-sized scalpel, mosquito artery clamps, medium-sized dissection scissors, and tissue forceps. For the cartilage I found the Freer submucous cartilage knife and the sharp and dull elevators used in nasal surgery most excellent. Number 0 catgut should be used for the buried sutures and fine black silk for the skin sutures.

Mr. J. D., twenty-seven years of age, was referred to me by Dr. L. B. Whitham, July 7, 1914, complaining of "protruding ears." The condition was congenital and had always been a sore point with the patient, who for some years had experimented with various bandages and head-gear designed to overcome such defects. Examination showed that the ears, though large, were well shaped, but that the attachment to the head was at an angle of 70°, an angle at least 40° too great. This malposition was due to an excessively curved conchal cartilage, the other convolutions being normal. The upper part of the ears flared with a slight

droop downward and forward. The lobules were normal. The object of an operation, in this case, was the correction of position only, and a modification of the method of Kolle [2] was adopted as best suited to meet the requirements.

Fig. 1 is a diagrammatic representation of the procedure. The dotted lines indicate the skin incision as shown by Kolle, and the shaded area shows the portion of cartilage that he removes. The mechanical effect of denuding such a skin-area is readily understood, but without the removal of the section of cartilage the effect so gained would soon be overcome by the elasticity of this tissue. Therefore, the ear must be made to lie without tension

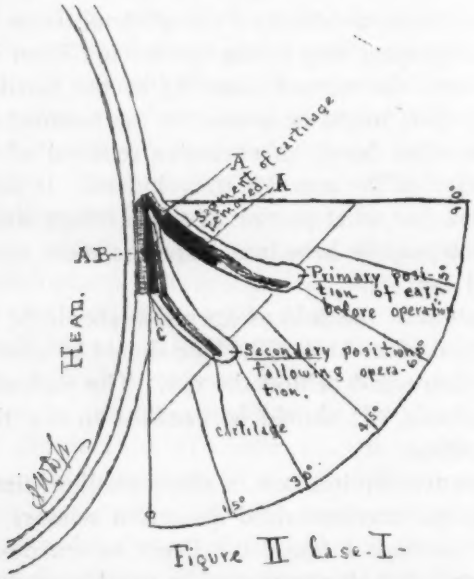

FIG. 2.—Case I. *AA*, suture in cartilage, 00 catgut; *AB*, suture *AA* tied, passed through periosteum and again tied, thus anchoring ear in new position and preventing tension at line of skin sutures, *C*.

in its new position, and this is effected by the removal of a segment of the cartilage. The heavy lines in Fig. 1 indicate the modification of Kolle's incision which I found necessary to make in the case of Mr. D., and the black area shows the portion of cartilage which I removed. I made this change, not only to meet the requirements of the individual case, but for the reason that in looking at the photographs of Dr. Kolle's cases it seemed to me that the post-auricular sulcus was too shallow, and that to gain an effect nearest approaching the normal the larger portion of the heart-shaped denudation should be made upon the scalp, and not on the posterior surface of the auricle. The effect of this incision is not

[2] Kolle, F. S.: Plastic and Cosmetic Surgery.

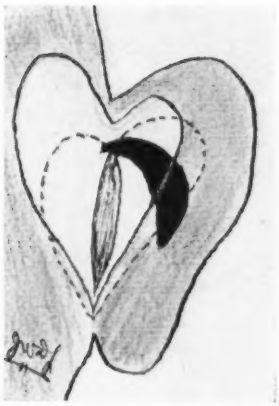

FIG. 1.—Case I. The dotted outline indicates Kolle's skin incision, the heavy line my modification for the case in point. The shaded area represents eliptical portion of cartilage removed by Kolle; the black area, the cartilage removed in my case. The portion beyond the incision is taken out subcutaneously.

FIG. 3.—Case I. Result of operation. The outlines indicate the position of the auricles before operation.

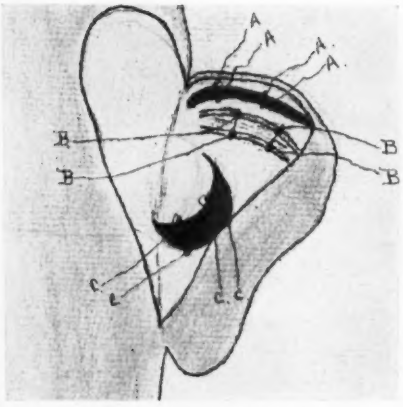

FIG. 4.—Case II. Outline of operative steps—right ear.

FIG. 5.—Case II. Outline of operative steps—left ear.

FIG. 6.—Case II. Condition of ears before operation.

FIG. 7.—Case II. Result obtained by operation.

FIG. 8.—Case II. Right ear.

FIG. 9.—Case II. Left ear.

only to retract the ear, but also to elevate it, and this result was particularly needed in the case under discussion. The section of cartilage removed was taken from the upper and posterior portion of the conchal curve, as this was the portion of the cartilage at fault. It was removed in a semilunar form for the reason that the edges would the more easily fall into coaptation, than had the incision been elliptical, as shown by Kolle. Fig. 2 schematically shows the mechanism of the operation and explains itself.

The steps of the operation were as follows: The area of skin to be removed was outlined with the knife down to the subcutaneous tissue and quickly removed with the scissors. All bleeding points were clamped and any vessel showing a tendency to continue bleeding was tied off. After the removal of the adipose tissue covering the cartilage, the semilunar segment to be removed was readily outlined with the Freer knife, and separated without difficulty from the skin covering the anterior surface of the ear, by the aid of the sharp and dull elevators used in the submucous operation upon the nasal septum. A finger of the left hand was kept in the concave surface of the concha to avoid perforating the skin. All care was used to remove the segment of cartilage without undue trauma, and this was readily accomplished with the instruments mentioned.

That the anterior configurations of the convolutions may not be distorted it is well to remove the smallest segment of cartilage consistent with the result desired, which is that the ear should lie in its new position by its own weight and without tension. If this effect be unobtained after what seems to be the excision of sufficient cartilage, the cut edges may be brought together with No. oo catgut, and this suture tied and passed down to and through the periosteum, thus acting as an anchor-stitch and holding the ear in its new position. In the case of Mr. D. this anchor-suture was not needed and was not used, though I have since reached the conclusion that it is a good plan in all cases, and shall hereafter always use it.

The ear having been placed in its new position and finding that it required no deep sutures and that the cut edges of the cartilage fell into coaptation, the skin was sutured with interrupted fine black silk sutures, silver foil applied, and over this a light gauze dressing. The bandage was carefully adjusted to give firm support without undue pressure.

The method employed was practically the same for both ears and both ears were operated on at the same sitting. The sutures were in part removed after four days, the remainder three days later. There was very little if any reaction from the cartilage wound and the skin healed with a hair-line scar. The bandage was

worn constantly for ten days, and at night for six weeks. The photograph [3] (Fig. 3, Case I) taken six months after operation shows the result obtained. Particularly note that there is a normal postauricular sulcus, a good conchal curve, and that the angle of attachment to the head has been markedly decreased.

The second case was much more difficult than the one just described and presented certain features requiring a different operation for each ear.

F. S., age nine, was first seen at the Baltimore Eye, Ear and Throat Hospital five years ago, and an operation was advised at that time, but the patient did not return. In August, 1914, the parents consulted Dr. H. O. Reik, who kindly referred the patient to me for operation. Both ears were attached to the head at an angle of nearly 90° and both were malformed. The right ear was crumpled and drooping and lacked an antihelix. The antihelix of the left ear was too prominent. Both ears were of good size (see Fig. 6, Case II).

Figs. 7, 8 and 9 show the result two weeks after operation. It will be seen that I have made an antihelix in the right ear. In the left ear the incision through the antihelix slightly distorts the anterior configurations of the convolutions, but this could not be avoided. Both ears set too close to the head, this also, in such a case, could not be avoided. The lobule of the right is slightly drawn; later, under cocaine, this can be easily remedied.

The method of operating upon the right ear was as follows (see Fig. 4): The area of denudation was made as shown in the drawing, the incision on the ear having to be carried to the extreme upper edge of the auricle. An elliptical section was then removed from the helix and the edges drawn together with No. 00 catgut (*A.A.*). Below and running parallel with this incision a fold was made in the cartilage and held with the sutures *B.B.* A semilunar portion of cartilage was then removed from the concha and the edges drawn together with the sutures *C.C.* The sutures *A.B.* and *C.* were then passed down and through the periosteum, securely anchoring the ear in its new position. The skin was sutured with fine silk interrupted sutures.

The left ear was operated upon as shown in Fig. 5. The skin denudation was practically the same. *A.A.* shows the section of cartilage removed from the helix, and *B.B.* the semilunar segment removed from the concha. The ear was anchored in its new position with sutures *A.* and *B.* The convolutions were packed with gauze and a firm bandage applied.

[3] The patient refused to have any photographs taken before the operation.

The patient was kept in bed twenty-four hours. The after-treatment was the same as described in the first case, and the result, so far as reaction was concerned, was as happy and unmarked by complications.

In conclusion may I say that whereas slight variations from the standard ear are the rule rather than the exception, such malformations as presented by the second case are not common, and certainly the correction of this deformity must prove a useful asset to the boy.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

Stated Meeting, held April 28, 1915

The President, Dr. Frederic Kammerer, in the Chair

NEPHRECTOMY AND PARTIAL URETERECTOMY FOR TUBERCULOUS KIDNEY IN A CHILD

Dr. Edwin Beer presented a girl, ten years of age, who had suffered from *enuresis* since infancy. For the past four years she had had infrequent pains in right loin. For the past ten weeks, had had incontinence by day, wetting clothes and bed every few minutes. Of late, there had been a slight improvement in this respect, the patient wetting herself only a few times each day. She had lost weight and strength. Patient transferred from service of Dr. Koplik.

Examination of urine showed pus, albumin and tubercle bacilli. Cultures were sterile.

March 6, 1915, cystoscopy and ureter catheterization under anæsthesia: Bladder capacity small. As soon as 1 ounce was introduced, there was bleeding. About the right ureter there was considerable exudate and retraction. The left ureter appeared normal. The left kidney secretes deep blue (indigo carmine) stained urine in twenty minutes. Left kidney: 2.4 per cent. urea, hyaline and hyalo-granular casts. No tubercular blood-corpuscles found.

On March 9 a right nephrectomy was performed. The kidney appeared outwardly normal, but the ureter which was lifted into the wound showed well-marked thickening. The ureter was tied off three inches from the pelvis and the kidney removed.

March 13, 1915, already patient holds urine better.

March 20, 1915, no tubercle bacilli in urine.

March 21, 1915, incontinence during day has stopped.

March 23, 1915, no tubercle bacilli in urine.

March 24, 1915, no tubercle bacilli in urine.

March 26, 1915, patient discharged, with practically no more evidence of bladder irritability, as shown by incontinence and enuresis.

Pathological Report.—Tuberculosis of kidney.

The interesting points in this case were: 1. The youth of the patient, suffering from renal tuberculosis. 2. The tuberculosis masquerading as enuresis in childhood. 3. The rapid improvement of the patient after operation. 4. The value of inspecting the ureter to see whether it is thickened, prior to nephrectomizing what looks outwardly like a normal kidney.[1]

HEPATOTOMY AND DRAINAGE OF LIVER ABSCESS

DR. BEER presented a woman, twenty-four years of age, who was admitted to the service of Dr. A. Meyer, February 26, 1914. She had had no previous abdominal disease. Six months prior to admission, after labor, bled once from hemorrhoids. The history obtained February 19, 1914, was that the present trouble began with fever and general pains; four days later, chill and cough. On admission there was jaundice, dulness at right base and distant bronchovesicular breathing, diminished voice and fremitus (septic pneumonia?). The jaundice became deeper, the liver grew larger, so that it could be felt four fingers below the ribs, and was tender anteriorly. White blood-corpuscles 18,000–20,000; polymorphonuclears 84–88 per cent. On March 3, there was some œdema in the superficial tissues in the epigastrium; distinct swelling behind the right upper rectus. Temperature 102°–106°; pulse 100–130; respirations 24–40. Urine: albumin ++, and granular casts. Exploratory laparotomy was performed the same day, under local anæsthesia. The liver (probably the left lobe) was exposed through upper right rectus incision. As there were no adhesions the abscess was not opened, but protecting packings were placed in the wound exposing the liver in the centre of the incision. Aspiration showed pus in liver. On March 5 the liver was incised with Paquelin cautery, packings left in place, and at a depth of ¾ inch a very large abscess was opened. A large drainage tube was introduced (no anæsthesia). During the next twenty-four hours about 1000 c.c. of pus drained off. The pus contained no amœbæ. Cultures from the abscess were sterile (?). Blood cultures were negative. The patient continued to run a septic temperature to 106.8°, with repeated chills. Hypos of emetine did not control the situation. March 20, liver aspirations were negative.

[1] Dr. Beer said that on first seeing the apparently outwardly normal kidney he doubted the trustworthiness of the diagnosis, although he had made the cystoscopy himself. As in other cases of this sort, he exposed the ureter before taking out the kidney, and found corroborative evidence.

During the next five weeks the jaundice gradually became less, and after the patient's transfer to the open-air (roof) ward there was a sudden marked change for the better. The discharge rapidly became less and the septic fever disappeared (probably the pus drained out through one of the large ducts). About six weeks after the original operation, the intraperitoneal packings were withdrawn, and on April 23, 1915, the patient was discharged well.

PAPILLOMATOSIS OF BLADDER: CAUTERY EXCISION

DR. BEER presented a patient in order to call attention to a method of treating these cases which is probably more efficacious than those formerly employed. The patient Dr. Beer owes to the courtesy of Dr. Lilienthal.

In 1906 the man had a suprapubic cystostomy performed for removal of papilloma.

March 3, 1915, cystoscopy revealed multiple recurrent papillomata. On March 10, an extirpation of the papillomata was performed by means of the Paquelin cautery. The bladder was exposed and freed. It was about the size of an orange, and was distended with the tumors. The perivesical tissues were thoroughly protected with packings, and then the bladder, which was drawn out of the abdomen, was incised and the papillomata cut away with hooked cautery, the bases being thoroughly charred. The entire interior of the bladder was carefully cauterized, the Paquelin being used for over one hour. Before closing the incision in the bladder, the edges were cauterized and then the wound was closed.

During convalescence, the patient developed facial erysipelas.

Patient was cystoscoped on April 12, and showed no sign of growth. The mucosa was pale pink, despite the extensive use of the cautery. There was no definite scarring of the mucosa. The patient has good control now and stands cystoscopy very well, and should any recurrence appear it can be easily burned off with the high frequency current. Some of the European surgeons recommend removal of the tumors by stripping off the mucous membrane from the muscle. Dr. Beer said that he had tried that method, but the results were not very satisfactory and that he believed the method followed in this case to be the safer and surer way of eradicating the disease.

DR. LILIENTHAL approved of the method of treatment employed, and agreed with Dr. Beer that it should be generally used.

He then told of an almost parallel case, occurring in an older man,

about six years ago. The man's bladder filled with papillomata forming soft masses almost as large as hen's eggs. Instead of operating as Dr. Beer had done, he cut away what he could and used the Paquelin cautery on the base. Now, after six years, the man has died of a condition which was probably carcinoma of the bladder. Possibly further treatment by cautery might have saved him, but he lived in a small town many miles away and he had evidently become discouraged.

FOREIGN BODY IN THE LUNG REMOVED BY LOWER BRONCHOSCOPY

Dr. Nathan W. Green presented a boy, six years of age, who was admitted to the surgical service at St. Luke's Hospital on December 16, 1914, special to Dr. Downes, suffering from a cough and fever. One month prior to his admission he began to cough, but was not ill enough to go to bed. His cough continued and grew worse, and five days before admission he grew markedly worse. He had lost weight and complained of pain in the right chest. Upon admission, he gave the signs and symptoms of a right empyema, for which he was operated upon immediately. As his condition did not clear up in the usual time, he was X-rayed by Dr. LeWald and the presence of an upholstery tack in the region of the right terminal bronchus was discovered as the cause of the delayed convalescence. Upon questioning the father more closely, it was recalled that the child swallowed a tack two years previously, but this had been forgotten. He was turned over to Dr. Green for bronchoscopic examination and for removal of the foreign body, if possible.

The physical findings at that time were dulness over the right chest posteriorly from the angle of the scapula to the base, with diminished voice and breath sounds and numerous large moist râles. An attempt was first made by means of an electromagnet introduced into the persisting sinus in the right chest to draw out the tack, but this failed. Repeated bronchoscopic examinations through the larynx showed granulations at the end of the right bronchus with pus exuding. The cavity which proved later to be surrounding the tack was not entered at this time. A tracheotomy was performed on March 2, and seven days later the boy was bronchoscoped through the tracheotomy wound. At this time the bronchoscope passed nearly to the cavity and forceps could be pushed into the cavity for two inches.

It was considered that part of the tack at least must be made of iron and so a small electromagnet, which passed through the smallest size of bronchoscopic tube, was made, and this was introduced through

the tube 10 days later, under combined ether and cocaine anæsthesia. The tack was mobilized by this means and brought up into the end of the bronchoscopic tube with the head of the tack across lumen of the tube. An attempt to grasp it failed and the procedure was then at once repeated. This time it brought the point of the tack into the bronchoscopic tube. It was then grasped by special forceps through the tube and, resistance to its removal being felt, a steady traction was made upon it as the child breathed, and little by little the resistance was overcome and the bronchoscope, and the forceps through it grasping the tack, were removed simultaneously. There was some bleeding from the granulations. A suction tube was at once introduced to remove this, and in a moment the bleeding stopped.

The child since then has been steadily improving. The character of the expectoration which at first was fetid and green has changed to a white expectoration without odor. The amount of expectoration has diminished, as well as the amount of drainage through the chest. The child is gaining in flesh.

The interesting points in the case are that the foreign body has remained in the lung for two years and that there was no attempt at encapsulation. It lay in a cavity in the lung at the end of the right terminal bronchus and this cavity contained about an ounce of pus.

FOREIGN BODY REMOVED FROM THE LUNG BY POSTERIOR THORACOTOMY

Dr. Green presented a man twenty-four years of age, who was admitted to the medical service of St. Luke's Hospital under Dr. Austin W. Hollis, suffering from cough and with a foul expectoration. Seven years ago he had a thoracotomy done in London for what appeared to be an empyema. The wound healed in five or six weeks and there has been no discharge since. The week previous to his admission he expectorated large amounts of foul-smelling pus, although coughing no more than usual. The sputum was greenish-yellow and there was never any blood in it. In short, he gave a clinical picture of a patient suffering from bronchiectasis.

On January 30, he was X-rayed by Dr. Truesdale, and this picture showed the presence of a foreign body. On January 31 and on three later days, he was X-rayed by Dr. L. T. Le Wald, who confirmed the diagnosis of a foreign body, and, by taking a picture at right angles, showed the true nature of the object, namely, that it was much the nature of a cotter pin. On going over the anamnesis, it was brought out that seven years before he had "swallowed" a badge fastener

which he thinks he was holding in his mouth when a comrade slapped him on the back. (The badge fastener was used to fasten the regimental badge to his uniform).

He was transferred to the surgical service March 20, 1915. Repeated attempts to find the foreign body were made by upper bronchoscopy, and, although the object could not be seen, in one of these attempts, the presence of a cavity was demonstrated, and in coöperation with Dr. LeWald, the nearness of the end of the bronchoscope to the foreign body was shown. Later this helped to locate the pin by measurements and by the X-ray. On March 29 the bronchoscope was introduced and the magnet introduced through it, with the hope that the foreign body might be of iron; then the X-ray picture was taken. This showed the magnet to be within an inch of the foreign body, but there seemed to be no tendency to attract it. It was decided then that it would be better to go in through the back and remove it in this way.

On April 1, three shot were placed on the skin as a marker and a piece of half-inch-mesh wire netting. A radiograph picture was then taken by Dr. LeWald in two directions. The distance of the foreign body was measured and found to be in one direction 6 cm. from the shot and lying just in front of the rib. On the same date, under local anæsthesia, two ribs were removed. The lung was found adherent to the parietal pleura as was expected, and found to have a hard spot in it. At the suggestion of Dr. Martin this hard spot was entered with a needle and found to be the wall of a cavity. The needle was followed with a pair of dissecting scissors and upon opening them the cavity was widely opened. A pair of Blake's gall-stone forceps was then introduced into the cavity and the foreign body grasped and brought out. A tube was then placed into the lung and the wound was partially closed, leaving drainage.

The interesting points are that the X-ray located the badge fastener; repeated attempts to see the object through the bronchoscope failed, but the bronchoscopic method furnished the following information. That there was something causing granulations which filled up the right terminal bronchus. Second, that there was a cavity at the end of the right terminal bronchus, 2½ inches in length. (This was proved by passing a probe through this scope and feeling it "give" as it passed the opening of the cavity.) Therefore the foreign body probably lay loose in this cavity. Third, that the foreign body lay well toward the base of the lung and just anterior to the rib. Fourth, that the most of the cavity was rather behind the bronchus than just at the end of it.

The convalescence has been more rapid than in the case of the child.

The character and odor and quantity of the sputum have changed markedly for the better, and the patient looks the picture of health.

Of course, in both of these cases, one does not expect the cavity in which these foreign bodies have been lying, one for two years and the other for seven years, to heal up immediately. The after healing of them is a matter to be observed in the future.

DR. LILIENTHAL said that it was his habit to have all empyemas X-rayed unless there was an absolutely clear history of the cause of the trouble such as an acute lobar pneumonia followed by empyema. He had seen a foreign body removed by bronchoscopy when the patient had been admitted for empyema. An X-ray picture was made and a foreign body was found which Dr. Yankauer removed without any cutting operation. Since then, he had made it a rule to have all empyemas X-rayed when there was no clear history of the case. Not only that, but if there is much doubt, the case should be examined with the bronchoscope even if a foreign body is not suspected from the radiograph.

Another point in Dr. Green's case is that the boy is apparently not yet well, even after this brilliant operation, the cause being perhaps a persistent bronchiectatic condition. Dr. Lilienthal said that in one case at least he had demonstrated the interesting point that foreign body bronchiectasis might persist after the removal of the cause. Six or eight months ago he had showed before the Society a patient, a child, whose entire right lower lobe he had extirpated for an acute bronchiectactic condition which persisted after the removal of a foreign body. The child was losing rapidly and was septic, so the desperate operation of lobectomy was performed as nothing else promised any relief. Examination of the specimen showed suppurative bronchiectasis but no evidence of the foreign body.

The other case presented by Dr. Green showed a very fortunate result and the patient would probably get well, even though there seems to be a rigid cavity which opens into the bronchus. The present condition is probably one of blind internal bronchial fistula.

Dr. Lilienthal said that he wished to emphasize the fact that bronchial fistula can close without a plastic operation. He had had two cases which he feared would persist, but which finally did granulate and close up.

DR. WALTON MARTIN said that he would not have expected either of these cases to show actual healing at this time. One was operated upon only a month ago and had been ill for two or three years previously.

It would seem almost incredible that a person who had had an abscess of two years' standing should be well after two months.

As to bronchial fistula closing: he had had three or four close up after proper treatment, *i.e.*, good drainage established on the outside, and then repeated washing with watery solution of methylene blue; this sets up a violent coughing, which evacuates the fistulous tract and the bronchial abscess. Some of these cases had been shown before the Society three years ago.

Dr. Green said that an interesting point in connection with these foreign body cases was the fact that when a foreign body is present it does not always cause a fatal bronchopneumonia, as used to be thought. One case, a boy who sucked a peanut into his lung, died two days later with bronchopneumonia. As Dr. Lilienthal had said, all these cases ought to be X-rayed, but some foreign bodies cannot be discovered in that way. Both the little boy who "swallowed" the tack two years ago and the man who sucked in the cotter pin seven years ago had bronchopneumonia and then went through a long period of invalidism before the foreign body was recovered.

GELATINOUS CARCINOMA OF THE BLADDER

Dr. Green presented a man, forty-six years of age, who was referred to him by Dr. C. Henderson, and was admitted to the surgical service of St. Luke's Hospital on April 23, 1914, suffering with a tumor, a little to the left of the median line, and "bladder trouble." Fourteen years before admission, bladder trouble started with pain, tenesmus and strangury. Diagnosis of vesical calculus was made at that time and external urethrotomy performed with but slight relief. For the last five months, prior to admission, tenesmus and strangury with frequency of micturition had been marked, with twenty pounds loss of weight in the year. One year before admission the tumor began to form. He denied lues and has twice had a Neisser infection.

Upon physical examination of the abdomen just above and extending to the left of the symphysis, but not connected with the skin nor the muscles, was a hard, firm, rounded tumor, about the size of an orange, slightly tender, which appeared connected with the fundus of the bladder.

Cystoscopic examination was made by Dr. H. G. Bugbee, April 24, 1914. He reported that the patient voided freely. Urine contained pus and shreds. The prostate was moderately enlarged per rectum, boggy, irregular, and became firm under massage. The seminal vesi-

cles were slightly enlarged and distended. The urine, after massage, contained a sediment of pus. A soft catheter did not pass through the membranous urethra owing to a stricture of long standing. A cystoscope passed with some difficulty. After irrigating the bladder it contained eight ounces of fluid which caused some discomfort. The mucous membrane of the bladder was slightly œdematous and markedly so in the region of the vesical neck. There were many flakes of mucus and pus loosely attached to the surface. The prostate was moderately enlarged intravesically, but not enough to cause an obstruction of the vesical neck. The ureteral orifices were normal. The urine coming from either kidney was clear. The mass palpable above the symphysis pubis was apparently connected with the bladder, but no intravesical communication could be detected. Bladder irrigations and instillations of the urethra were given until May 22, 1914, when another cystoscopic examination was made.

At this time the bladder retained eight ounces of fluid without discomfort. The mucous membrane of the bladder was slightly pale but otherwise normal, and at the top of the fundus of the bladder, in the median line, a small orifice (3 mm. in diameter) could be seen. From this orifice a gelatinous substance exuded into the bladder. The bladder was filled with a solution of coliargol and the radiograph showed a regular outline of the bladder wall, no fluid passing through the above opening.

Operative Procedure.—May 26, 1914, a midline incision below umbilicus, and the tumor was exposed. The peritoneum was stripped from tumor but had to be widely opened in one spot in order to get it free. The tumor was removed, including the involved bladder wall, 2 inches in diameter. The bladder was sutured then, using three layers of fine chromic gut, and a large suprapubic rubber tube was inserted for drainage. The peritoneum was closed very carefully with catgut. The rest of the wound was partially closed with catgut and silkworm gut. Two small drains of rubber dam were inserted.

Pathological Findings.—The tumor seemed to have originated from the upper wall of the urinary bladder, into which it had partially ruptured and was discharging its mucilaginous contents. The tumor itself was as large as an orange, rather nodular, definitely encapsulated, containing a soft, friable, gelatinous material. There was no attachment of the tumor to any other viscus than the bladder. The intestines, large and small, appeared absolutely normal.

Pathological report by Dr. A. B. Eisenbrey, May 26, 1914:

Specimen consists of a tumor mass measuring 12 × 8 × 7 cm., removed from posterior wall of bladder. Mass showed a generally dense fibrous structure and considerable adipose tissue attached. One surface showed an area of bladder wall about 5 cm. in diameter, with an irregular ulcerated surface, in which gelatinous material is present. The bladder wall is continuous with the main tumor mass, which on section consists of very dense fibrous tissue forming spaces filled with a gelatinous material. The central portion of the tumor is composed largely of this material.

Microscopical Examination.—Sections from margin of ulcerated area in bladder wall show marked œdema, congestion, and round-cell infiltration and active invasion of the bladder wall and mucosa by a neoplasm composed of columnar epithelial cells, in a typical glandular arrangement. In many of the alveoli, the cells are of the mucous type and the alveoli are filled with a mucoid material.

Sections from main tumor mass show a very dense fibrous stroma forming small and large spaces filled with the mucoid material. Some of the spaces show epithelial structures, but in many the epithelium is entirely degenerated.

The neoplasm bears a close resemblance to the gelatinous carcinoma of the intestinal tract. Neoplasms of this type, however, are described as arising primarily in the bladder wall.

On April 14, 1915, patient was again examined by Dr. Bugbee. His report is as follows:

Patient emptied the bladder; urine contains a few shreds. Bladder retains eight ounces of fluid. Top of fundus of the bladder shows a smooth linear scar 3 cm. in length. The mucous membrane of the bladder is normal with the exception of numerous elevations scattered throughout. These elevations are about the size of the head of a pin, hard and rounded. There were no nodules at the site of the scar.

The patient has gained fourteen pounds since leaving the hospital and is able to do his day's work. He has, however, some difficulty with his micturition such as was present for fourteen years previous to his operation. The patient was presented, on account of the interesting type of tumor which, as has been noted, bears a close resemblance to gelatinous carcinoma of the intestinal tract, but was primary in the fundus of the bladder.

Dr. Beer said that primary adenocarcinoma was such a rare occurrence that he was somewhat inclined to doubt such a diagnosis. The prostate is the usual source of adenocarcinoma of the bladder, also metastasis from the intestines occurred in the bladder, and in view of the site of this tumor it was a question of whether it might not have risen from some of the structures about the umbilicus.

Dr. Green said that the neoplasm bore a close resemblance to the gelatinous carcinoma often found in the intestine. As nearly as could

be determined, this was primary in the top of the bladder. It could not be called one originating in the urachus, and Dr. Eisenbrey was unwilling to say that it bore any resemblance to such a growth.

INOPERABLE RECURRENT SPINDLE-CELLED SARCOMA OF THE SUPERIOR MAXILLA; DISAPPEARANCE UNDER TWO AND ONE-HALF MONTHS' TREATMENT WITH THE MIXED TOXINS OF ERYSIPELAS AND BACILLUS PRODIGIOSUS

Dr. Wm. B. Coley presented a man, forty-five years of age, who had been referred to him by Dr. Joseph Bissell, on February 20, 1915.

Dr. David L. Satenstein, the patient's family physician, stated that the man came to him on April 18, 1913, at which time he had a very small tumor, the size of a cherry, situated between the bicuspid and first molar teeth, on the left upper jaw.

At the time of the patient's admission to Dr. Coley's service at the General Memorial Hospital (February 20, 1915) he had a large radium burn on the left side of his face, about one inch in diameter. The skin was not broken, but was exceedingly red and tender. There was another larger burn, measuring 1½ inches in diameter, on the left side of his face, and still another a little below the first one. The left side of tongue was raw and very painful. He could open his mouth only three-quarters of an inch, and had a large and constant flow of saliva so that it was impossible for him to say more than a few words without wiping his mouth. Examination at this time showed a tumor of the upper jaw, extending backward as far as the furthest limits of the jaw, and reaching considerably below the alveolar process. It was too extensive for radical operation, and the patient's general condition was bad. He was put upon the mixed toxins (systemic injections given into the pectoral region) and the dose was carried up to seven minims. No other treatment was used. At the end of five weeks the larger portion of the tumor had become soft and necrotic, and under ether anæsthesia Dr. Coley scooped out a large amount of completely and partly broken-down tumor tissue; there was considerable hemorrhage. After two or three days the drain was removed with further necrotic material, and the wound was carefully cleaned with permanganate of potash. A week later practically none of the tumor was left in the posterior and upper part of the superior maxilla, the only portion remaining being near the anterior part of the left superior maxilla, beginning at a level with the canine tooth, and extending backward about an inch; this was still firm. The toxins were continued every other day for

a month, at the end of which time the tumor has practically disappeared. The patient's general condition has markedly improved.

NOTES.—In the course of his previous history it is recorded that several Wassermann reactions were tried and all were negative, although Dr. Satenstein says that 3 to 4 years ago, before the sarcoma developed, the patient had a positive Wassermann, and that he gave him several doses of salvarsan.

A section of the primary growth was removed shortly after its detection and on microscopical examination declared to be spindle-celled or fibro-osteosarcoma.

A second microscopical examination was made by Dr. Ewing, who reported: giant-celled sarcoma. The material for this examination consisted only of the broken-down and almost completely necrotic tissue removed two months after the toxins were started.

Clinically, the tumor was a periosteal sarcoma, entirely unlike the giant-celled or epulis type of sarcoma.

Dr. Coley presented also a woman who had been operated upon by Dr. A. E. Isaacs, at the Beth Israel about eight years ago, for a very extensive intra-abdominal sarcoma.

The pelvis was cleaned out as well as possible, but a recurrence was seen to be inevitable as all the organs were involved in the adhesions. She made a prompt recovery from the operation, but leaving a fistula. X-ray treatment was begun, but caused such a dermatitis that the toxins were substituted, the toxins being administered by Dr. J. C. Reshower.

The microscopical examination report furnished him by Dr. Isaacs pronounced the disease " round-celled sarcoma with a few small spindle-cells."

At the time the toxin treatment was begun, the whole abdomen was apparently filled with an inoperable tumor. The prognosis was regarded as most unpromising. The toxins were begun on July 7, 1908, at which time the patient still had a fistula from the previous operation. The injections at first were given daily, then every other day, then twice a week, beginning with one-half minim, and increasing each time by ½ minim. The patient proved to be rather susceptible to the toxins, 1¼ minims producing a severe chill, and temperature of 103°. She became more tolerant as the doses were increased, and by the beginning of April, 1909, had received sixty injections, the highest dose being 11 minims. During this period, the tumor in the abdomen apparently disappeared, and the patient has been in good health up to the present time.

Ever since the operation, the patient has had occasional slight swelling in the right foot and leg, with frequent pains. She was married two years ago, but has never been pregnant. Dr. Coley examined her, under ether, at the General Memorial Hospital a week ago, and with the exception of a small swelling about the size of a goose-egg (probably a cystic ovary) on the right side, nothing of a suspicious nature could be found. The patient is in excellent general health, seven years after the treatment was begun.

DR. LILIENTHAL expressed a doubt as to whether the surgeons were using these toxins as frequently as they should. He had seen three cases of cure resulting from the use of Coley's serum, in which the diagnosis of sarcoma had been made. In all three cases only partial operations were possible, and much of the tumor was left *in situ*. In one instance the tumor disappeared, recurred, and again disappeared under the use of the toxins.

TUBERCULOUS PYONEPHROSIS

DR. HOWARD LILIENTHAL presented a woman, twenty-eight years of age, who had been admitted to Mount Sinai Hospital on March 15, 1915, with a temperature of 101.2°; pulse 98; respirations 18. Five years before she had had a so-called cold abscess of the right flank which had been opened at Mount Sinai Hospital. This had healed completely. For about seven months prior to the present admission patient had had pain in her right side, sharp or dull, but continuous; frequency of urination; and had had suprapubic pain for a week. No other symptoms.

The patient was found to be in excellent general condition. She had some cough, but no expectoration. There were lung signs over the right supraspinous region. There was a tumor, evidently the kidney, in the right lumbar region, and a long sausage-shaped mass running down from this tumor into the pelvis, evidently the ureter. There was a tender mass in the right vaginal fornix.

The urine was acid, 1024; contained albumin, pus, and epthelial cells; and was cloudy. No tubercle bacilli were found.

Cystoscopy was performed on March 17 by Dr. Martin Ware, who stated that the left ureter was normal and that the right orifice was œdematous and reddened. The left ureter, on catheterization, emitted clear, apparently normal, urine; the right, thick, white, purulent fluid.

On March 18, under ether anæsthesia, the usual incision parallel to the twelfth rib was made, and the rib was dislocated upward. An

enormous adherent fluctuating kidney was with great difficulty peeled away from the surrounding parts, and the ureter was located. This structure was divided between ligatures and the stumps thoroughly carbolized. It then became possible to fashion a pedicle in which the vessels were felt, but this pedicle, on account of the great inflammatory exudate, was as thick as four adult fingers. It was crushed with a clamp and then ligated with heavy chromicized catgut. The patient was then turned upon her back, an incision about two inches long was made parallel to Poupart's ligament, with its inner termination at the right rectus muscle. Extraperitoneally, the ureter was found, and, having been digitally loosened from above before the patient was turned over, it was easily withdrawn from the wound. On attempting to ligate it closer to the bladder, however, the ureter tore off. The wound was then sutured, a small split tube being put in for a drain. The patient was then again turned over upon her side, and the wound closed in three layers with heavy chromicized catgut for the deeper parts and silk for the skin. The enormous hollow left by the removal of the kidney was filled with saline solution, which was locked in by the tightening of the last two sutures (method of W. J. Mayo). The pedicle had been carbolized, fearing that some of the thickening may have been due to infective material.

The patient was discharged well, on April 6, 1915, after perfect primary union.

This case was presented to demonstrate the fact that the removal of a tuberculous ureter is an easy operation. It was not done, however, because it was easy but to remove a tuberculous focus which in this case would have been liable to make trouble later. The ureter was found to be tuberculous almost throughout. What would have happened had the patient been treated according to the usual method could not, of course, be said, but she would probably have had a fistula still. She had no fistula now.

Dr. Lilienthal said that he had done this operation over twenty times in tuberculous conditions and that he intended to continue calling attention to the method, as he did not think the operation had received the attention it deserves. For some reason surgeons seem to consider it a difficult operation, which it is not. The argument that the ureter gives trouble in only 5, or in 2 per cent., of the cases is a poor one. Surgeons of eminence say, "Take it off as far down as possible, and seldom anything happens." Why take it off as "far as possible"? There is no use in doing more than need be done, but one should surely do all that ought to be done. Dr. Lilienthal said that

he had been disappointed to read again of the method of Wm. J. Mayo, of sewing the ureter in the wound to leave a fistulous opening to close when it would.

Dr. Lilienthal, in closing, said that although treating the wound without drainage might in some instances be followed by late infection the chances for a permanent cure after primary union were, on the whole, good. In the event of the late appearance of signs of pus the wound could be reopened wth little trouble and the ever-present danger of the mixed infection of a recent wound in a tuberculous region would be avoided.

Dr. Ellsworth Eliot, Jr., said that both the late Drs. Alexander and Tilden Brown emphasized the fact that the tuberculous lesion was most marked at the beginning and the end of the ureter and that the intervening portion was generally normal. He had noticed at least one exception to this rule in a case of extensive tuberculosis of the kidney in which the ureter was involved not only in the beginning and end but also at the point where it crossed the pelvic brim, where it was so extensively involved as to be adherent to the vascular sheath. Usually, however, the median portion of the ureter is free from pathological change, and under such circumstances the removal of the kidney and as much of the ureter as is accessible through a lumbar incision would leave a possible tubercular focus in the terminal portion only. This was the general opinion expressed in a meeting of this Society several months ago in which the phrase of "the removal of as much as possible of the ureter" evidently referred to the removal of that part of the ureter lying above the pelvic brim.

Dr. Lilienthal had stated in the case presented that the lower part of the ureter gave way during the manipulation involved in its removal; possibly the tear of the ureter may have been due to the fact that it was involved in the tubercular process. If he had not misunderstood, Dr. Lilienthal also stated that a drain was inserted to this point indicating the possibility of the presence of tubercular necrotic material.

In all those cases in which practically the entire ureter is removed the terminal part must usually be left and that is not infrequently diseased. In this particular part of the body, as elsewhere, the surgeon must be satisfied with the removal of the major part of the tuberculous process and be content with leaving that which he fails to remove to the healing and reparative power of nature, which generally yields satisfactory results. The patient to whom he had referred had no persistent fistula. She was observed for five years, and then died of tubercular meningitis.

DR. ALEXIS MOSCHCOWITZ said that this subject comes up again and again in the discussion of this conditon. Personally, he is rather surprised at it, because he has had no trouble with tuberculous fistula after extirpation of the kidney and ureter, or of as much of the ureter as was indicated. Within the past three months, however, he had been disappointed. He had operated upon a case with the following history. The patient, a young lady, had been referred to him, with a history of frequent urination. She was cystoscoped and the ureters were catheterized; tubercle bacilli were found in the urine from the right kidney. Extirpation of the kidney was advised, and this was done. Upon exposure the kidney appeared to be to all intents and purposes normal; this is merely mentioned in order to show that no tuberculous material was spilled in the wound during the operation. The kidney and about five inches of a perfectly normal ureter were extirpated. On examining the specimen a small tuberculous abscess, not larger than the tip of the little finger, was found in the upper pole of the kidney. The pelvis and extirpated ureter were normal. The wound was closed without any drainage and healed so that the patient was discharged from the hospital in less than two weeks. She returned about a week ago with an undoubted tuberculous infection of the wound, with a sinus discharging pus. In this case, however, the presumption is very strong, that the infection of the wound occurred not at the time of the original operation, but secondarily through a systemic tuberculosis.

DR. EDWIN BEER said that there is no doubt that the surgery of tuberculosis is incomplete. One can never remove all the disease, and in following the advice to remove as much as possible one would need to take out some of the bladder as well, for that is frequently involved around the ureter. In the last year he had done six complete ureteronephrectomies, and he selected those in which the tuberculous process had produced a ureter stenosis. He has had to do secondary ureterectomies for tuberculosis, and had found it more difficult than (any other) at the primary stage. He had done immediate suture of kidney incisions in tuberculous cases, and the wound had closed by primary union, but in 6 weeks it had broken down with extensive tuberculosis of the whole wound. How is that to be explained? He had been studying the question by injecting guinea-pigs with blood taken from the patient on the operating table to see whether there was a traumatic bacteræmia. As yet he had found none. Examination of the perineal fat also failed to throw any light on these wound infections. It is peculiar that when a ureteronephrectomy is done through two incisions and nothing is spilt, that the lower wound in which there

remains the tuberculous stump of the ureter almost regularly heals without trouble, whereas the kidney incision which has not been and is not contaminated, is liable to show signs of a tuberculous infection. The question comes up, is this not due to a lymphatic infection as the retroperitoneal lymph-vessels ascend towards the kidney hilus? I believe the persisting lumbar sinuses are more often due to this than to the disease within the ureter that has been left *in situ*, and the fact that such sinuses are not infrequent even when the whole ureter is removed bears out this contention.

Dr. F. Kammerer said that he rather feared to close a wound tightly after removal of any localized tuberculous focus. Theoretically, of course, after complete eradication of all tuberculous material closure of the wound without drainage was justifiable. But, if any diseased tissues had been overlooked, a recurrence was more likely to develop in a hermetically sealed wound than in one which was allowed in part to granulate. In the latter instance, a certain supervision of the granulating surfaces and an early detection and removal of recurrences was possible. This was especially true of tuberculous disease of the bones with involvement of the surrounding soft parts, but the speaker thought the principle was also applicable to renal tuberculosis, especially in far advanced cases.

COMPARATIVE MALIGNANCY OF CARCINOMA OF THE APPENDIX

Dr. Forbes Hawkes read a paper with the above title.

Dr. William Darrach reported three cases of carcinoma of the appendix, two of which he had been able to follow, one for six months and the other for a year and a half. The second case occurred in a woman twenty-nine years of age who was operated upon a diagnosis of appendicitis which turned out to be a tubo-ovarian abscess. Routine examination proved it to be carcinoma. The other case was operated upon for acute appendicitis; the proximal portion was found to be gangrenous and the distal portion proved to be carcinoma. The third case he had not been able to follow.

Dr. Eliot asked whether in any of the cases there had been a recurrence of the carcinoma after the appendectomy. He himself had never seen any, and had never read of it in the literature.

Dr. Hawkes said that the first case mentioned in his paper (Berger, 1882) had a recurrence apparently. The appendix was removed. Later an autopsy was performed, and there were metastatic growths.

Dr. Green said that in January of this year the House Surgeon

operated upon what was apparently an acute appendicitis. The appendix was entirely involved by a carcinomatous invasion, being as large as one's thumb. The patient gave a history of having had recurring mild attacks for twelve years. There were glands in the meso-appendix and the omentum was involved, showing metastases. The patient was discharged in January without the knowledge of his condition, and had not reported since.

CARCINOMA OF THE PAPILLA OF VATER

Dr. John F. Erdmann presented a young man, a little over eighteen years of age, whom he had first seen in March at the Post-Graduate Hospital. At that time there was a tumor in the right half of the epigastric space, which could be moved very slightly. It presented some symptoms suggesting tumor of the gall-bladder or pylorus. He had a marked lemon color, and gave a history of loss of weight. An X-ray picture led to a diagnosis of tumor or ulcer of the transverse portion of the duodenum; this was corroborated by an exploratory operation. Upon operation a large mass in the third and fourth portions of the duodenum was found; in addition there were two very large retroperitoneal glands imposed upon this growth. The gall-bladder was profoundly distended, showing pressure obstruction of the common duct. Feeling that there might be an ulcerative process, the peritoneum was incised over the involved portion of the duodenum, and stripped off, one gland the size of an English walnut was removed, revealing quite a large hole in the transverse portion of the duodenum with a slough of intestine plugging the opening. A finger was inserted proximally and encountered an almost complete obstruction; then passing it in the opposite direction it was again checked, but not so completely. This mass was hard and apparently malignant. A cholecysto-gastrostomy and a gastro-enterostomy were done, the hole in the duodenum repaired, and the abdominal incision closed. That was on March 23. The lemon color disappeared in five or six days, the patient was able to take food and has continued to do so ever since. The pathologist reported that the specimen was an adenocarcinoma. The patient returned to-day, and examination revealed a recurrence of the condition throughout the upper abdomen.

Dr. Erdmann said that this was the second case of the kind that he had presented before the Society—the other having been shown at a former meeting about 18 months before—a male about forty-two years old. In that instance a gastrojejunostomy was done, followed by a cholecystojejunostomy some months later.

The sites of these growths were out of the normal anatomical position of the papilla of vater, but he felt that in each instance, owing to the common duct obstruction, in the absence of pancreatic invasions, he had to deal with an abnormally placed papilla with malignancy.

DR. KAMMERER asked Dr. Erdmann if his case might not have been a carcinoma at the papilla Vateri, starting from the glandular epithelium of the gall-ducts. He had himself observed and operated on one such case, about ten years ago, in a man of fifty, in which a carcinoma, about the size of a hazel-nut, was found in the common duct, exactly at the papilla. The growth was removed, but the patient unfortunately died on the third day.

DR. MARTIN said that the papilla is quite irregular in its position. Sometimes it is situated near the lower end of the vertical portion of the duodenum; it is possible that a carcinoma might have its origin in a papilla so displaced.

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ANNALS *of* SURGERY
227-231 S. 6th Street
Philadelphia, Penna.